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Vegetation Response after Wildfires in National Forests of Northeastern Oregon

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Charlie Johnson
Baker City, Oregon

INTRODUCTION

Fire -- Natural Disturbance; Rejuvenating Event

Fire was once an integral function of the majority of ecosystems in northeastern Oregon, adjacent Idaho, and southeastern Washington. The seasonal cycling of fire across the landscape was as regular as the August and September lightning storms plying across the canyonlands and mountains. Depending on the plant community composition, structural configuration, and buildup of dead plant biomass, fire resulted from the ignitions with varying intensities and extension across the landscape. The shorter the return interval between fire events, the less dramatic would be the changes in plant composition. With infrequent return intervals, plant communities tended to burn more severely and be replaced by vegetation different in composition, structure, and age (Johnson, et al. 1994).

Fire periodicity in the Blue and Wallowa Mountains

The past decade has resulted in fires of larger size burning at higher intensities than had occurred previously in this century in northeastern Oregon. In the warmer, drier Blue Mountain forests, the tree component has changed from domination by fire-dependant species to dense undergrowth of fire- susceptible species. Because fire has not been permitted to perform its natural role of frequent underburning (ponderosa pine-dominated stands) or replacement burning (fir-dominated stands), forest vigor has diminished. This has contributed to frequent outbreaks of insects and disease epidemics that have further increased the probability of large stand replacing fires (Hall 1980).

This contrasts sharply with the likelihood that the majority (80%) of Blue Mountain forests historically burned at low severity. Only 5% burned with high severity; the remainder (15%) burned moderately (Agee 1996). The burn intensities in the forest plots of this study are indicative of the trend toward higher severity burns. This is based on the drier climate of the past decade, the buildup of fuels, and dense stocking with fire-promoting sapling, pole, and intermediate-size trees. Had fire performed at regular intervals, there would have been a greater number of moderate and light burn intensities on the plots. Interestingly, of the 73 forested plots used in this study, 68% were severely burned, 21% were moderately burned and 11% burned lightly. A comparison of burn intensities estimated by Burned Area Rehabilitation specialists from BAER reports for the largest fires in the study area provided this interesting comparison:

Blue Mountain Fires - low = 33%, medium = 23%, high = 44%

Wallowa Mtn. Fires - low = 33%, medium = 44%, high = 23%

Canyonland Fires - low = 80%, medium = 6%, high = 14%

This comparison portrays the study area's fire characteristics well. The lowest-intensity burns would occur in the shrub and grass-dominated canyonlands. The highest-intensity burns would be in the drier montane ecosystems of the Blue Mountains while the Wallowas would be intermediate between the Blues and the canyons. Based on Agee's estimate of historic burn intensities above, all three areas have burned recently with much greater intensities than in the historic past.

The lengthening of fire intervals has contributed to fires burning more severely in communities where fire once passed through with less severity owing to lighter fuels. Deep-rooted tree species such as ponderosa pine, Douglas-fir and western larch are considered "fire seral" species that withstand heat and charring. But as the fire frequency is lengthened, a greater accumulation of duff occurs beneath the tree canopies. As a result, the deep-rooted trees develop fine roots that are oriented closer to the surface in the mineral soil. Now even some low-intensity burns can pose an increased risk of high tree mortality because the duff concentrates lethal heat for a longer duration and kills surface roots (Scott, et al. 1996; Agee 1993).

Fire Resistance

The vegetation of the Blue Mountains is highly adapted to periodic fire in forest, shrubland, and grassland ecosystems. Flanagan (1996) rated the principal tree species into categories of resistance. The trees occurring in the Blues, Wallowas, and Seven Devils rate as follows on his scale:

very high resistance - western larch

high resistance - ponderosa pine and Douglas-fir
moderate resistance - grand fir
low resistance - lodgepole pine, whitebark pine, subalpine fir, Engelmann spruce

Agee (1996) categorized the ability of plants to survive fires using the plant's survival strategies following fire. A group of trees easily killed by fire were termed "avoiders." Examples are western juniper, grand fir, subalpine fir, Engelmann spruce and whitebark pine. Trees capable of surviving low-intensity fires were termed "resisters." Examples include ponderosa pine, Douglas-fir, and western larch. A tree capable of resprouting from the base after top-kill was termed an "endurer." An example is quaking aspen. A tree that is killed but reproduces from a seed bank is called an "evader." Lodgepole pine is our best example.

The adaptations that enable the vegetation to survive, increase site occupancy, and to attain renewed vitality are as varied as our flora. The following is provided as a sample of common plants with their adaptations taken from Agee (1996):

Thick bark enables ponderosa pine, Douglas-fir, and western larch to sustain moderate and light underburns. Shrubs that sprout from rootcrowns and rhizomes are snowberries, ninebark, Scouler willow, huckleberries, and rabbitbrushes. Grasses with perennating buds protected in foliage of their crowns are bluebunch wheatgrass and Sandberg's bluegrass. Plants that require the heat from burning duff to scarify their thick seedcoats are snowbrush ceanothus and lupines. And windblown seed from fireweeds allow for rapid site invasion from adjacent unburned areas.

Root systems and where they are situated in the substrate often determine the ability of a plant species to survive. McLean (1969) provided a resistance rating for shrubs and herbaceous plants. It is exemplified by some plants common to many plots of this study.

resistant (taproots or fibrous roots with rhizomes 5-13 cm. deep) e.g., snowbrush ceanothus, birchleaf spiraea

intermediate (shallow rhizomes) e.g., pinegrass, creeping Oregon-grape, heartleaf arnica

susceptible (rhizomes in duff, shallow fibrous roots and stolons) e.g., sidebells pyrola, twinflower

Rangeland communities where woodlands, savannas, shrublands and grasslands regularly occur are composed of species with varying responses to burning. Historically rangelands have been visited by fires on frequent return intervals. As with forest stands, there has been a decreased frequency of fires over the past century resulting primarily from human intervention. As a result there has been an increase in fire-susceptible plant species in rangelands. Similarly to the increase of firs in ponderosa pine-dominated forests, junipers and sagebrushes have increased in density and extent in sites where high-frequency burns once kept them subordinate to fire-adapted vegetation (Burkhardt & Tisdale 1976; Shinn 1980).

Plants found frequently in shrubland and grassland study plots had predictable responses to the varying fire intensities. An important source of fire effects information is in the "Fire Effects Information System" (Fischer, W.C. et al. 1996). As an example of the known responses to fire by some of the native species of importance in this study, the following listing is provided from Boyer and Dell (1980) and Strang (1989):

mountain big sagebrush - easily killed; resprouts on moist ground.
antelope bitterbrush - resprouts on moist ground; weak resprouter on dry sites.
rabbitbrushes - vigorous resprouter after fire.
Idaho fescue - susceptible to severe damage by fire owing to perennating buds located in the dense basal tufts where fire can burn hot and linger.
bluebunch wheatgrass - withstands fire well owing to open tufts.
prairie junegrass - tolerant and resistant to fire damage.
Sandberg's bluegrass - tolerant and often spreads to niches left by other plants eliminated by the burn.
cheatgrass - promoted by repeated burning and may increase in density.
pinegrass - very tolerant to fire; increases rapidly afterwards.

Ground surface features that exhibited changes with different fire intensities were litter, moss, lichen, and bare ground. Cryptogams often spread into the niches left by consumed vegetation (plants and litter). On the sites with light burning

the cryptogam layer was often unaffected. On moderately burned sites, mosses often showed dramatic increases in the first and fifth years after the burn. Conversely by the fifth year, on some sites quick to respond with herbaceous vegetation, cryptogams declined because of increased litter accumulations. On the severely burned sites, mosses and lichens often were killed, but the dead crust organisms continued to provide a stabilization for the soil by protecting from raindrop and wind erosion. This was observed by Johansen and Rayburn (1996) on the Arid Lands Reserve near Richland, Washington.

Using Fire as a Tool

Fire has been a governing factor in providing a rich mosaic of plant communities across the varied landforms of northeast Oregon. The haphazard nature of fire's pathway, periodicity, and ignitions provided various patch sizes, textures, and kinds of vegetation as a result. The probability of fire in any given place was a function of chance, the position on the landscape, and the vulnerability of the plant community to fire (Johnson 1994).

Today the unprecedented combination of decreased low-intensity surface fires, increased stand-replacing fires, and fire-exclusion management practices has resulted in a high percentage of plant communities vulnerable to crowning fires. This gives high probability of fires burning with a severity and pattern not previously experienced by some vegetation and may result in different successional pathways (Arno, et al. 1985).

As a result, reliance on prescribed natural fire to rectify this imbalance may not be desired by natural resource managers. Using management-ignited prescribed fire may be a more strategic way of re-incorporating fire into the ecosystems. In forests, the unprecedented buildup of down woody material along with the unprecedented dense understory layers may require silvicultural treatment in addition to landscape-scale burning to emulate effects of natural disturbances.

The effects of fire on trees, shrubs, and herbaceous vegetation will depend on fire intensity, which is a function of the season and the climatic pattern occurring at the time of the fire. Vegetation response will also be affected by key factors linked to the growing season following the burn: plant germination and sprouting along with the use of emerging vegetation by animals (Bunting 1996). Not only is plant vigor improved by fire along with plant community diversity, but forage production and palatability for ungulates are often improved as well (Adams 1989). Elk increases in the past 20 years have accentuated early spring use on gramineous plants throughout northeastern Oregon. As prescribed fires create earlier seral stages of vegetation across the mountainous and canyon landscapes, elk will be attracted to the succulent vegetation of the burns. Having larger prescribed burn units may spread the use by elk and mitigate this problem of concentrated use on emergent vegetation. Land managers should take into account the ungulate response when determining the scale of prescribed fire projects.

A SUMMARY OF FINDINGS

Fires are haphazard in where they burn and how severely they burn and therefore enhance biological diversity by providing for varied structure and species composition across a landscape.

- Fire severities influence the ability of a species to compete, invade, or maintain its presence/dominance on a given site.

- Fire is a natural ecosystem process that has always affected the organisms in the inland Pacific Northwest in a cyclic manner.

- The curtailment of wildfires has enabled virtually all plant communities to have greater biomass and less vigorous vegetative growth, with resultant vulnerability to pathogenic organisms and wildfires of greater severity and size.

Forests

Subalpine Fir Series - All tree species were negatively affected by stand replacement burning in the first 5 years except for lodgepole pine. Most shrubs associated with subalpine fir plant associations showed a resilience by the fifth year. Shrub species not prominent in late seral stages of subalpine fir communities were becoming prominent in the early fire seres (e.g., black elderberry, Scouler willow). In the herbaceous layer, later seral species declined or were eliminated by the fire (e.g., sidebells pyrola). Other species were enhanced by moderate to severe burns (e.g., heartleaf arnica). Pioneers on severe burns

(e.g., fireweeds, pearly everlasting) were rapid colonizers providing protective ground cover.

Grand Fir Series - Grand fir succumbed to the moderate and severe burns. After 5 years, fire seral tree species (e.g., lodgepole pine, western larch, Douglas-fir) were occupying sites in the cool, moist grand fir plant associations. On moderate and severe burns, in the warm, dry grand fir plant associations, ponderosa pine was an important fire seral species after five years. On these drier sites grand fir had not returned in the fifth year. Shrubs capitalizing on severe burns in grand fir plant associations were snowbrush ceanothus, creeping Oregon-grape and Scouler willow. On drier grand fir plant associations grouse huckleberry was enhanced by moderate and severe burns. The herbaceous layer in cool, moist grand fir communities demonstrated increases by pinegrass, elk sedge and fireweeds following moderate and severe burns. On warmer, drier grand fir sites, pinegrass, elk sedge, and mountain brome increased with moderate and severe burns. Prominent forbs that responded to the severe burns on warm, dry grand fir sites were bull thistle, fireweeds, and lupines.

Douglas-fir Series - Severe burns were detrimental to tree retention in the first 5 years. However moderate and light burns retained Douglas-fir and enhanced ponderosa pine occupancy. Shrubs were resilient to severe burns and increased dramatically in the fifth year (e.g., ninebark, spiraea, snowberry). Redstem and snowbrush ceanothus entered Douglas-fir sites following severe burns. Pinegrass and western fescue were prominent increasers with moderate and severe burns. Compared with true fir plant associations, which occupy cool, moist environments, Douglas-fir plant associations are warmer and drier. Therefore, pinegrass was negatively influenced on Douglas-fir sites in all fire severities the first year after the fire but responded vigorously with increases by the fifth year. Elk sedge was negatively influenced by severe burns in Douglas-fir plant associations. Forbs responding well to moderate and severe burns were strawberries, mitella, fireweeds, yarrow, and cleavers.

Ponderosa Pine Series - Severe burns eliminated ponderosa pine from the site the first 5 years after the fire. At the other extreme, light burns enhanced ponderosa pine communities with reduction of duff and establishment of seedlings. Of the shrub species associated with ponderosa pine plant associations, common snowberry responded vigorously after 5 years. On severe burns pinegrass, fireweeds, yarrow, and annual bromes were promoted. Light burns increased lupine, pinegrass, Idaho fescue, and annual bromes.

Shrublands

Severe burns promoted ninebark on cool, moist sites, but spiraea and common snowberry were negatively affected. On big sagebrush sites moderate and severe burns were detrimental to mountain big sagebrush, mountain snowberry, and rabbitbrushes the first year after the fire. However, by the fifth year these shrubs were responding vigorously with prominent occupancy of the sites. Mountain mahogany was negatively affected by severe burning but withstood moderate burns. Grasses responding favorably to moderate and severe burns were pinegrass, bluebunch wheatgrass, and annual bromes. For the most part, the apparent duration of fire in the shrublands was injurious to Idaho fescue. Forbs of prominence in shrublands, with a positive response to severe burning, were miner's lettuce and heartleaf arnica. Moderate burning promoted goatweed in fifth-year samples taken in low elevation shrublands.

Grasslands

Bluebunch Wheatgrass Series - Light and moderate burns enhanced bluebunch wheatgrass but severe burns negatively affected that species. Sandberg's bluegrass was quick to colonize new sites the first year after severe and moderate burns, but was unable to enhance its occupancy on light burns. Annual bromes were quick to increase the first year on light to moderate burns but declined on severely burned sites. By the fifth year, annual bromes were showing increases on severely burned sites. Arrowleaf balsamroot was the consistent increaser among forbs in bluebunch wheatgrass communities the first year after moderate to severe burns.

Idaho Fescue Series - Among the bunchgrasses, Idaho fescue demonstrated the greatest vulnerability to moderate and severe burns (especially the first year after the fire). By the fifth year, it was generally increasing in

coverage on lightly burned sites and on low-elevation sites burned moderately or severely in the Idaho fescue - prairie junegrass plant association. In other Idaho fescue plant associations it was still negatively affected 5 years after the fires. Prairie junegrass demonstrated increases the first year after burns in Idaho fescue communities but declined by the fifth year owing to competition from annual bromes or bluebunch wheatgrasses. Forbs negatively affected by burns in Idaho fescue communities the first five years were twin arnica, arrowleaf balsamroot, and red avens. Annual forbs notably enhanced by fire in these communities after 5 years were tall annual willowweed and prickly lettuce.

Ground Cover

Following severe burns the ground was generally devoid of standing biomass. Even moderate burns tended to leave a high percentage of the sites with bare ground or ash. However, this was of short duration in the plant associations of northeastern Oregon. By the first year following the most severe burn, mosses, liverworts, and pioneering forbs (e.g., fireweeds) assisted in the rapid rehabilitation of the biotic community. The principal coverage of bare ground immediately following the fires in forested sites was by needle fall from moderately burned trees. On light burns the discontinuous nature of the fire left the ground surface with unburned litter for ground protection on portions of the sites. The following is a synopsis of results for forests, shrublands, and grasslands:

Forests - The year following the fire, litter generally declined from pre-burn coverages. Then, by the fifth year, litter coverage was often nearly returned to pre-burn levels. In grand fir and subalpine fir plant associations the burn was usually severe. Here shrubs, sedges, forbs, and grasses were totally consumed along with down woody material. The response by fire liverworts and mosses the year after the severe burns was dramatic (e.g., 50% liverwort cover in grand fir/beadlilly plant communities; 0% liverwort cover by year five).

Shrublands - Litter and bare ground percentages traded places predictably from year one (bare ground cover highest) to year five (litter cover highest). Mosses and lichens tended to be in pre-burn and post-burn shrub communities with low coverages.

Grasslands - Following severe and moderate burns, litter was diminished by consumption of both the standing biomass and the litter on the ground. By the fifth year it often exceeded the pre-burn levels owing to additional biomass from annuals. In the rocky sites where bluebunch wheatgrass plant associations often occur, the cryptogams (mosses and lichens) are especially prevalent. Mosses and lichens were often bypassed by the flames on these sites. Heat, however, did cause mortality and decreases in post-burn cover of living mosses and lichens. The dead cryptogam layer did provide protection to the soil from erosive agents. On fescue sites mosses and lichens often surrounded bunchgrass tufts as occupants of the cooler, moister micro-environment provided by the bunchgrass foliage. Here, beneath the bunchgrasses, cryptogam mortality was greater than in the drier bluebunch wheatgrass communities.

HISTORY OF THE STUDY

In 1986 a rash of wildfires occurred across a wide area of the Blue and Wallowa Mountains and adjacent canyonlands of northeastern Oregon. The fires, starting in August and coupled with dry vegetation, produced burns of larger sizes and greater severities than had been the historic norm. As a result, a fire effects study was initiated by Deputy Forest Supervisor Joe Stockbridge for the fires of the Wallowa-Whitman National Forest.

One of the underpinnings of the study was that many ecology plots and rangeland condition and trend transect clusters (C&T) pre-dating the fires were located on the largest burn of the 1986 fires. Plots established from 1978 and C&T clusters dating from 1959 to 1965 were plentiful across the Joseph-Starvation Burn complex. In both cases vegetation cover data by species and photographs taken from fixed camera points recorded the plant communities prior to the burn.

Where plots did not exist, plots and camera points were established as reference points for following the succession of plants after the fire.

The study was designed with three phases as follows:

Phase 1 - Observations were made soon after the fire-fighting activity had culminated. The extent and severity of the burn at the site was recorded. If not already existing, fixed camera points and plots were established at this time.

Phase 2 - The first growing season following the fire, vegetation response was documented by sampling plant composition using the techniques employed previously. Photographs were taken from the permanent camera points to compare with pre-burn photographs.

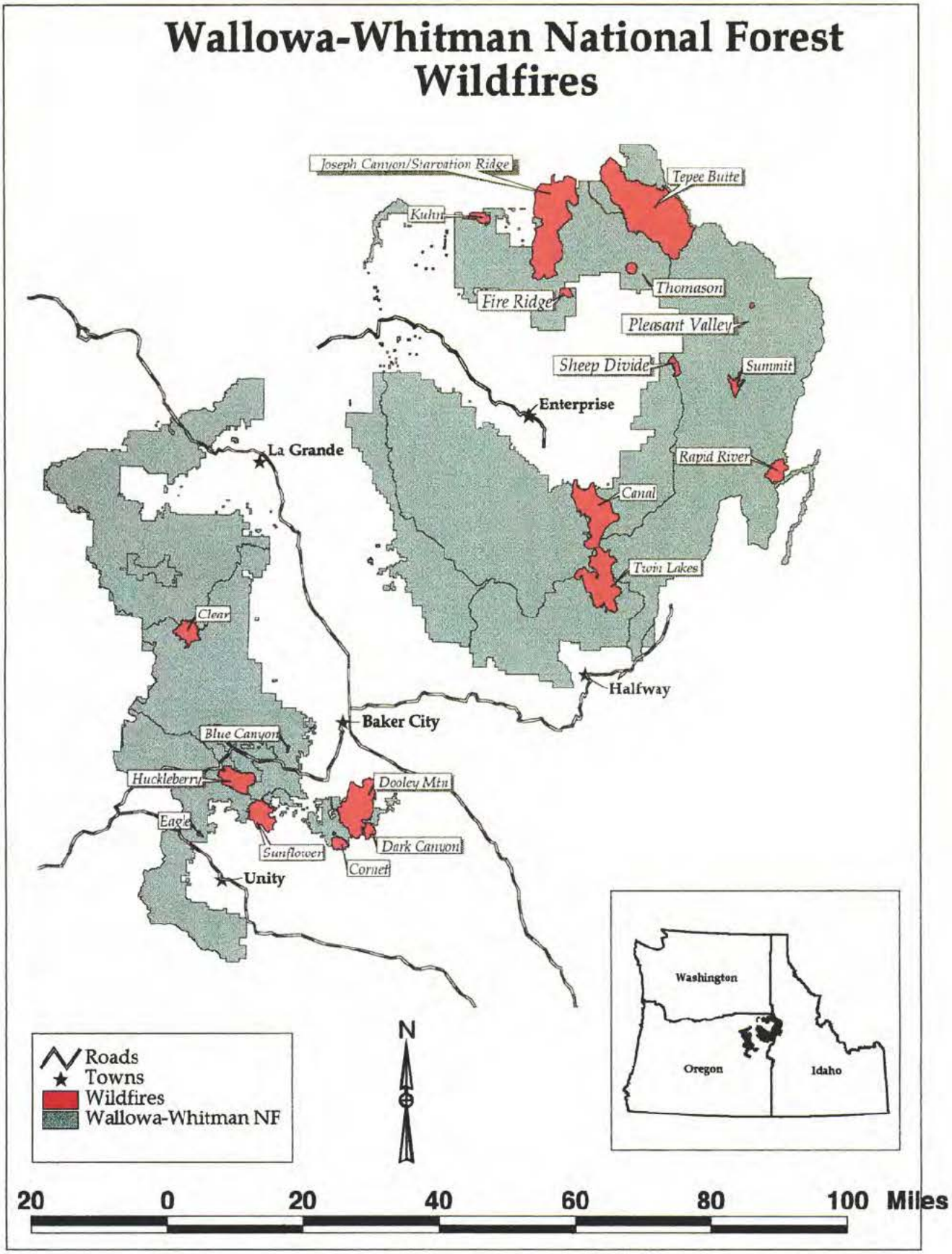
Phase 3 - This was the vegetative trend phase. Sampling and photo documentation occurred the fifth year after the "first year" sampling and was planned for 5-year intervals as long as it was determined to be feasible.

Photography was/is a hallmark of this study. Liberal use of the camera resulted in both general landscape views and specific plot views. In the case of plots established after the fire, photography taken immediately after the burn served as the benchmark.

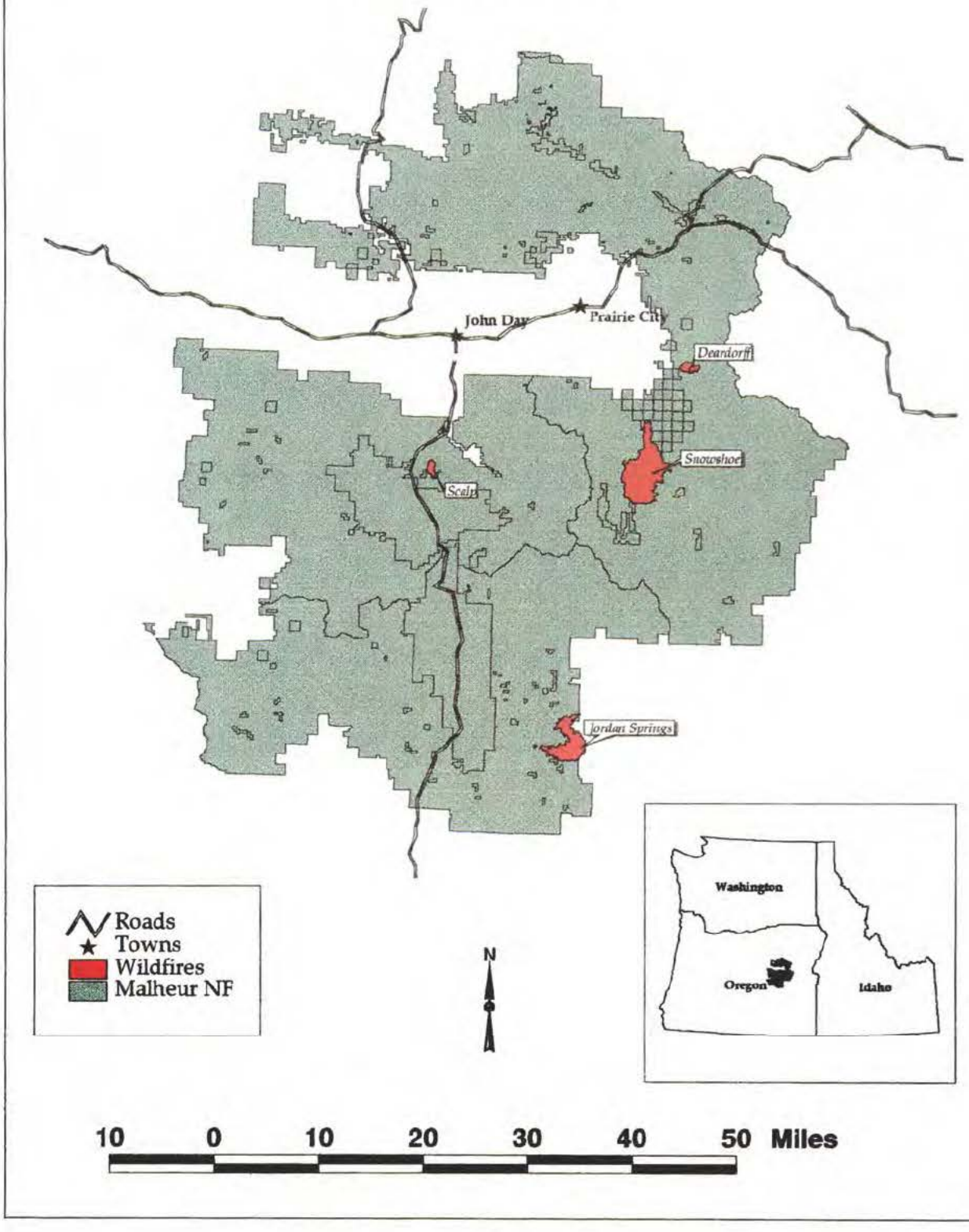
It was envisioned that following the fifth year, findings would be disseminated. However, large fires occurred on the three Forests in 1987, 1988, 1989 and 1990. The study was expanded to encompass those fires in order to re-sample plots that pre-existed on the Umatilla and Malheur National Forests.

The fires used in the study can be found in appendices C & D. They are organized by year, Forest, and Ranger District, and include a brief capsulized history. The locations of the fires can be found on maps of each National Forest on the following pages.

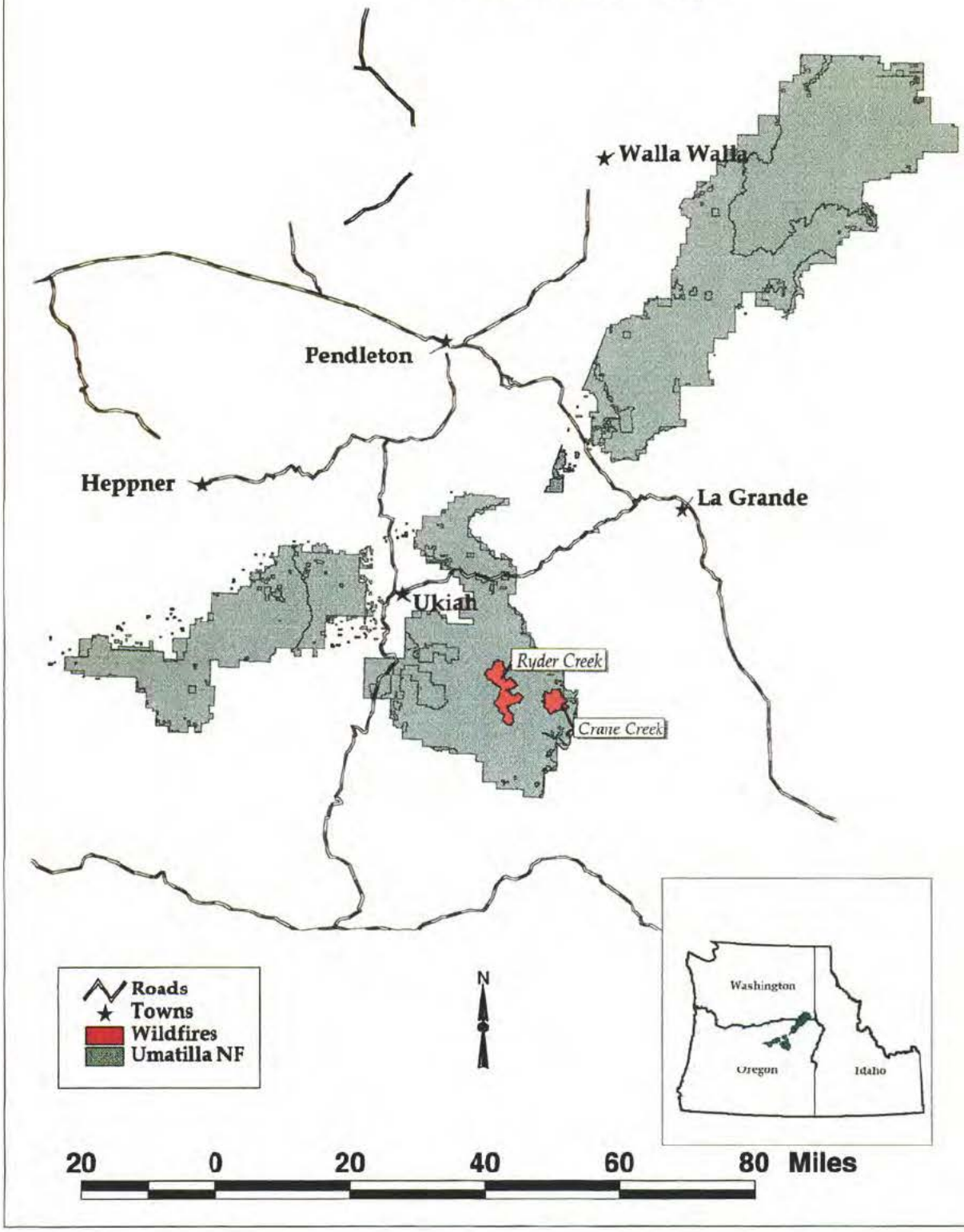
Wallowa-Whitman National Forest Wildfires



Malheur National Forest Wildfires



Umatilla National Forest Wildfires



The following table provides a summary of the sampling of 1986 - 1994 burns:

Burn Year	No. of Fires	No. of Plots
1986	18	75
1987	2	7
1988	1	48
1989	3	20
1990	1	6
1994	5	29
TOTAL	**30**	**185**

Thirty fires were included in this study. A total of 185 plots provided information for the comparative analysis. Usually the plots were re-sampled the first and fifth years following the burn. One burn (Deardorff) was resampled in the 8th year instead of at year five. Plots located on the 1990 and 1994 burns have only been read once (since their fifth anniversary has not yet arrived).

Plots were resampled as either 375-sq.-meter circular fixed areas (nearly a tenth-acre) or as 1-square-foot quadrats located at specific settings along transects. In all cases the sampling replicated the past sampling technique. For burns lacking pre-existing plots, areas were selected that were considered representative for the burn severities that characterized the fire and that included the dominant vegetation.

Burn Severity

Burn severity has been categorized as "low, moderate, and high" (Agee 1993); "low, medium, and high" (Morrison and Swanson 1990); "light, moderate, and severe" (Boyer and Dell 1980); "light, moderate, and heavy" by Ryan and Noste (1985); and by the National Park Service (1992) as "unburned, scorched, lightly burned, moderately burned, and heavily burned."

The burn severities used in this study, and written as categories within each plant association, are defined as follows:

Partial Burn (mosaic)
The plot area contained a mixture of burn severities with no one severity dominating.

Light Burn

Forest Vegetation: leaves and twigs on tree branches partially to completely scorched; mature trees mostly underburned

Shrublands/grasslands: shrubs with some singed/consumed leaves, but majority unscathed; grasses with standing culms (singed or blackened); and tufts with surface char at most.
Cryptogams: unscathed
Substrate: litter charred to partially consumed in forest communities; litter unscathed or partly consumed in grasslands

Moderate Burn

Forest Vegetation: leaves and small twigs on tree branches completely scorched; stems and tree trunks charred and partially burned
Shrublands and grasslands: shrubs with consumed and singed leaves, stems blackened; grasses with culms consumed or blackened; tufts charred with unburned crown.
Cryptogams: partially burned or scorched
Substrate: litter and woody debris partially consumed and logs blackened in forest communities; litter partially consumed in grasslands and shrublands

Severe Burn

Forest Vegetation: all leaves, stems and twigs on tree branches consumed; trees and tree trunks deeply charred with branches mostly consumed.
Shrublands and grasslands: shrubs consumed with only blackened stubs above the ground surface; grasses with culms consumed; tufts consumed or crown blackened.
Cryptogams: blackened or consumed
Substrate: litter and duff consumed; white ash prevalent; logs deeply charred or consumed.

PLANT ASSOCIATIONS AND FIRE'S EFFECTS

The following constitutes the summary of fire's effects, by burn severity, to key plant associations of the Wallowa and Blue Mountains and associated canyonlands. The format is repetitive in a sequence that leads from grasslands to forests.

Changes are noted from pre-burn through the first and/or fifth years following the fires and tables of percentage cover of key plant species are provided. Since the sample size is often quite small, the mean provided is also accompanied by the range of values. The small sample size is a result of a fire happening to occur where a pre-existing plot was located. Following the text and table for each plant association, pictures are presented exemplifying the changes on a representative plot.

Bluebunch wheatgrass - Sandberg's bluegrass (Basalt) plant association (AGSP-POSA3)

Two plots were available in this plant association predating the Joseph-Starvation Burn of 1986. One plot was burned severely; the other was burned moderately. Both plots were on steep southerly slopes (avg.= 69%) at elevations of 4200 ft and 4540 ft. The vegetation was resampled the first (1987) and fifth (1991) years after the burn.

Severe burn findings

Bluebunch wheatgrass declined from 35% prior to the burn to 20% five years after the burn. Sandberg's bluegrass also declined. The only other plants to decline were western yarrow and lupine. Increasing with this severe burn were annual bromes (cheatgrass, soft chess, rattlesnake brome, and Japanese brome); arrowleaf balsamroot; and yellow salsify.

Entering the community for the first time following the burn were tall annual willowweed, prickly lettuce, and narrow-leaved skullcap. Litter increased and bare ground declined over the five years. Cryptogams increased on the plot area.

Moderate burn findings

Bluebunch wheatgrass increased from a pre-burn 13% to 20% coverage five years after the burn. Sandberg's bluegrass increased from 4% to 12%. Showing declines over the five years were western yarrow and annual bromes. Lupine increased slightly. Entering the site for the first time after the burn were arrowleaf balsamroot, prickly lettuce, tall annual willowweed and stork's bill.

Litter, bare ground, and mosses all declined over the period. Lichens made an entry in the fifth year at 4% cover.

Summary

The severe burn was detrimental to both principal bunchgrasses whereas the moderate burn enhanced bluebunch wheatgrass in the community.

The lower coverages of bluebunch wheatgrass, Sandberg's bluegrass, and annual bromes in the fifth year on the moderately burned plot may be attributed to drought conditions coupled with grazing pressure from elk and cattle combined. It would seem reasonable that bunchgrasses and annual grasses would be stimulated by the moderate burn to higher coverages than those sampled. Notes taken to the possible effects of drought and early grazing by elk lend credibility to this possibility.

Bluebunch wheatgrass - Sandberg's bluegrass (BASALT) plant association (AGSP-POSA3) (n=2)

Burn Intensity	Severe (n=1)			Moderate (n=1)		
Species	**PRE**	**1**	**5**	**PRE**	**1**	**5**
Grasses						
bluebunch wheatgrass (AGSP)	*35	29	20	13	18	20
Sandberg's bluegrass (POSA3)	5	7	2	4	11	12
annual bromes (BROMU)	6	4	11	8	11	4
Perennial Forbs						
western yarrow (ACMIL)	10	4	3	5	1	2
arrowleaf balsamroot (BASA)	3	5	6	0	3	1
lupines (LUPIN)	3	1	1	1	1	3
narrow-leaved skullcap (SCAN)	0	1	1	0	0	0
Annual Forbs						
tall annual willowweed (EPPA)	0	0	1	0	0	1
stork's bill (ERCI)	0	0	0	0	0	1
prickly lettuce (LASE)	1	0	1	0	0	1
yellow salsify (TRDU)	1	1	2	1	0	1
Litter	20	14	32	25	18	17
Bare Ground	30	18	7	33	26	22
Moss	0	1	1	12	4	6
Lichen	0	0	1	0	0	4

* Average Cover (%)

AGSP-POSA3 (Basalt)

Plot 119 Established - 1978 Burned severely - 1986 Joseph-Starvation Fire
Horse Pasture Ridge, Wallowa Valley RD, Wallowa-Whitman National Forest

July 1978 – Bluebunch wheatgrass dominates (35%) with Sandberg's bluegrass subordinate (5%). Annual bromes are present at cover of 6%, yarrow (10%), and arrowleaf balsamroot (3%).

September 1986 – Burned continuously – all above-ground biomass consumed.

June 1987 – Bluebunch wheatgrass dominant (29%) with slight increase by Sandberg's bluegrass (7%). Annual bromes present at cover of 4%, yarrow (4%), and balsamroot (5%).

Bluebunch wheatgrass - Sandberg's bluegrass - skullcap plant association (AGSP-POSA3-SCAN)

Two plots were available to portray the effects of fire in this plant association. One plot was moderately burned on the Joseph-Starvation burn of 1986. The other plot received a light partial burn from the Teepee Butte Fire of 1988. Both plots were on steep (avg. = 52%) southwest slopes. Elevations differed with the moderately burned plot located at 2840 ft. and the lightly burned plot at 3500 ft. Both plots pre-existed the burns and both were resampled in year one and year five following the fires. Both sites are rocky and gravelly averaging 35% cover by those features at the ground surface.

Moderate burn findings

Bluebunch wheatgrass declined slightly over the 5-year period following the fire (18% to 14%). Skullcap was initially absent the year after the fire but had re-entered the site by year five. It was present at only a 1% cover after initially occurring at 10% prior to the fire. Annuals made large strides at colonization after the fire. Annual bromes (cheatgrass and rattlesnake brome) tripled; tall annual willowweed entered by the fifth year at 10% cover; and prickly lettuce increased on the site. Litter increased; bare ground declined; and cryptogams increased.

Light burn findings

Bluebunch wheatgrass at first declined (24% to 16%) but by the fifth year had rebounded to 25%. Skullcap was constant at 5%. Increasing with the burn were Sandberg's bluegrass and annual bromes (rattlesnake brome and cheatgrass). Plants remaining constant throughout the period were yarrow, blepharipappus, and silky lupine. Litter increased; bare ground declined; and mosses decreased.

Summary

The decline in bluebunch wheatgrass by the fifth year on the moderate burn may be attributed to ungulate grazing pressure. The loss of skullcap on the moderately burned site indicates the heat that is conducted through the rocks and gravels to effectively kill the skullcap plants growing within that medium.

With a normal fire cycle these communities would burn partially and lightly as exemplified by the Teepee Butte Burn plot. The moderate burning of the Joseph-Starvation plot's vegetation is more representative of absence of regular fire entry into the system.

Bluebunch wheatgrass - Sandberg's bluegrass - skullcap plant association (AGSP-POSA3-SCAN) (n=2)

Burn Intensity	Moderate (n=1)			Light (n=1)		
Species	**PRE**	**1**	**5**	**PRE**	**1**	**5**
Grasses						
bluebunch wheatgrass (AGSP)	*18	24	14	24	16	25
annual bromes (BROMU)	3		9	5	5	13
Sandberg's bluegrass (POSA3)	0	1	0	1	5	0
Perennial Forbs						
narrow-leaved skullcap (SCAN)	10	0	1	6	6	5
western yarrow (ACMIL)	1	0	1	1	2	1
silky lupine (LUSE)	0	0	0	2	1	2
Annual Forbs						
tall annual willowweed (EPPA)	0	0	10	0	0	1
prickly lettuce (LASE)	1	1	4	1	0	1
blepharipappus (BLSC)	1	0	0	1	1	1
fiddleneck (AMRE2)	0	0	0	0	1	12
Litter	28	No	47	50	15	59
Bare Ground	14	Data	10	17	42	7
Moss	1		3	9	2	2
Lichen	0		4	0	0	0

* Average Cover (%)

AGSP-POSA3-SCAN

Plot 550 Established - 1981 Burned lightly - 1988 Teepee Butte Fire
Experiment Creek Canyon, Hells Canyon NRA, Wallowa-Whitman National Forest

May 1981 – Bluebunch wheatgrass dominated (24% cover) with Sandberg's bluegrass present at 1%. Annual bromes provided a cover of 5%; skullcap (6%). Surface cover was litter (50%); mosses (9%), and bare ground (17%).

September 1988 – Partially burned by a light severity fire.

June 1989 – Bluebunch wheatgrass remained dominant (16%). Sandberg's bluegrass increased from 1% to 5%. Skullcap and annual bromes remained constant. Surface cover changed dramatically - litter dropped to 15% cover; moss cover was reduced to 2%; and bare ground increased to 42%.

July 1995 – Bluebunch wheatgrass and Sandberg's bluegrass returned to pre-burn cover. Annual bromes almost tripled (25%) and occupied the bare ground following the burns. Skullcap remained constant.

Bluebunch wheatgrass - Sandberg's bluegrass - prickly pear plant association (AGSP-POSA3-OPPO)

One plot was selected to study fire's effects on vegetation in this plant association. It was established prior to the Teepee Butte Fire of 1988. The plot was only partially burned (the area that did burn was of light severity). It was sampled in the first and fifth years following the burn. It is a south aspect with a slope of 26% at 3650 ft elevation.

Light burn findings

Bluebunch wheatgrass was enhanced by this light burn. It increased from a pre-burn cover of 8% to a fifth-year cover of 13%. Sandberg's bluegrass was constant throughout the period. Occupancy by prickly pear declined greatly. Annuals were the only other plants to increase from the light burn. Blepharipappus and annual bromes (cheatgrass and rattlesnake brome) each made small increases. Over the period, litter increased; bare ground declined; mosses declined, and lichens made a slight increase. Prickly pear is vulnerable to mortality from heat generated by the fires as well as by actual burning. However in most colonies some "pads" remained after the fire to serve as the initiators of future post-burn colonies.

Bluebunch wheatgrass - Sandberg's bluegrass - prickly pear plant association (AGSP-POSA3-OPPO) (n=1)

Burn Intensity	-------Light-------- (n=1)		
Species	**PRE**	**1**	**5**
Grasses			
bluebunch wheatgrass (AGSP)	*8	7	13
Sandberg's bluegrass (POSA3)	1	1	1
annual bromes (BROMU)	5	7	8
Perennial Forbs			
prickly pear (OPPO)	6	0	1
Annual Forbs			
blepharipappus (BLSC)	1	1	3
Litter	14	4	20
Bare Ground	11	11	3
Moss	53	28	27
Lichen	1	1	2

* Average Cover (%)

AGSP-POSA3 (Basalt)
Plot 549

1981 – A bluebunch wheatgrass-dominated (mid-seral stage) community. Bluebunch wheatgrass cover was 8%; prickly pear cover was 6%. Mosses and lichens averaged 54%.

1988 – The fire burned lightly with standing culms and leaves of the bunchgrasses being consumed. Prickly pear pods were killed by the heat.

1989 – The first year after the fire, bluebunch wheatgrass rebounded to near pre-burn cover. Prickly pear was absent; killed in pre-fire colonies. Mosses and lichens were impacted by the heat of the fire; cover now was 28%.

AGSP-POSA3-OPPO

Plot 549 **Established - 1981** **Burned lightly - 1988** **Teepee Butte Fire**

Experiment Creek Canyon, Hells Canyon NRA, Wallowa-Whitman National Forest

May 1981 – Bluebunch wheatgrass dominated (8% cover) with Sandberg's bluegrass present at 1%. Prickly pear was prominent (6%). Annual bromes covered 5%. Surface cover by mosses was 53% on this rocky site.

September 1988 – Site was lightly and partially burned.

June 1989 – Bluebunch wheatgrass and annual bromes were co-dominant at 7% cover. Sandberg's bluegrass was constant at 1%. Prickly pear was killed by the burn. Mosses declined to a cover of 28%.

July 1995 – Bluebunch wheatgrass increased by the fifth year following the burn to 13%. Annual bromes, Sandberg's bluegrass, and mosses remained constant. Prickly pear germinated and constituted a cover of 1%.

Sandberg's bluegrass - onespike oatgrass plant association (POSA3-DAUN)

Two plots established prior to the Thomason Burn of 1994 were used to study the effects of fire on the vegetation of this plant association. Both plots were very lightly burned with high percentages of the plot areas unscathed by the fire. Both were on broad, gentle ridgetops (slope avg.= 5%; aspects westerly). Elevations were 4540 ft and 4680 ft. The plots were resampled only the first year after the burn.

Light burn findings

Sandberg's bluegrass increased from 18% to 23% the first year following the burn. Onespike oatgrass did not fare as well. It declined from a pre-burn coverage of 13% to only 2% after the burn. Moss cover declined; lichens increased.

Other findings

Lanceleaved stonecrop and slenderfruit desert-parsley both made increases on the sites. These increases were attributed to disturbance in early spring when these scablands are saturated with winter snowmelt. Elk use these communities in early spring to graze on the early developing bluegrass leaves. Consequently the animals upturn the plants and leave hoof depressions, which become bare ground available as colonizing sites for the stonecrop and desert-parsleys. It is not clear that the bluegrass increases and the oatgrass decreases are attributable solely to the light burn; the impact of the elk may be partially responsible for some of the shifts.

Sandberg's bluegrass - onespike oatgrass plant association (POSA3-DAUN) (n=2)

Burn Intensity	--Light/Partial-- (n=2)	
Species	**PRE**	**1**
Grasses		
Sandberg's bluegrass (POSA3)	***18**	**23**
	◆(6-30)	(21-25)
onespike oatgrass (DAUN)	**13**	**2**
	(11-15)	(1-3)
Perennial Forbs		
lanceleaved stonecrop (SELA2)	**4**	**6**
	(3-5)	(1-10)
slenderfruit desert-parsley (LOLE)	**6**	**9**
	(5-6)	(3-15)
Litter	**4**	**3**
	(1-6)	(1-4)
Bare Ground	**2**	**1**
	(1-2)	(1-1)
Moss	**45**	**32**
	(31-60)	(25-39)
Lichen	**2**	**8**
	(0-3)	(7-10)

* Average Cover (%)
◆ Range of Cover (%)

POSA3-DAUN

Plot 173 **Established - 1979** **Burned lightly - 1994** **Thomason Fire**

Vance Knoll, Wallowa Valley Ranger District, Wallowa-Whitman National Forest

September 1994 – Partially burned with light severity.

June 1995 – Sandberg's bluegrass increased from 6% to 21% cover. Desert parsley also increased (6% to 15%). Onespike oatgrass declined significantly from a pre-burn cover of 11% to only 1% the year after the fire. This could be a reflection of soil moisture loss inhibiting oatgrass survival.

Idaho fescue - prairie junegrass (ridgetops) plant association (FEID-KOCR)

Four plots were used to study fire effects on vegetation belonging to the Idaho fescue-prairie junegrass plant association on ridgetop and upper slope positions. The plots are all located on the Joseph-Starvation burn of 1986 and pre-existed the fire. Vegetation on three plots burned moderately while the fourth plot was lightly burned. Two plots have northerly aspects and two have westerly aspects. Slopes where the plots are located are gentle (5% to 22%) with an average of 11%. The elevations range from 4300 ft to 5000 ft (avg.= 4625 ft). The plots were sampled the first year and fifth year after the burn.

Moderate burn findings

With the exception of a minor showing by rose, shrubs are absent from these communities.

The principal herbaceous species of this plant association are Idaho fescue, bluebunch wheatgrass, prairie junegrass, Sandberg's bluegrass, and silky lupine. Both Idaho fescue and bluebunch wheatgrass declined in the first five years after the burn. The fescue declined from 25% to 15%; the wheatgrass declined from 26% to 14%. The other bunchgrasses (Sandberg's bluegrass and prairie junegrass) maintained their cover at low levels (5%) from pre-burn to post-burn periods. Perennials showing slight declines as a result of the fire were yarrow; arrowleaf balsamroot; phlox; and silky lupine. Annual plants showing an increase the first year and then declining by the fifth year were: pale alyssum, shining chickweed, and yellow salsify. Plants maintaining a constant cover throughout the pre and post-burn periods were annual bromes (cheatgrass, rattlesnake brome, and Japanese brome), narrow-leaved collomia, and prickly lettuce. Tall annual willowweed made a dramatic increase in the fifth year following the burn. On one plot Kentucky bluegrass was prevalent before the burn (7%); tripled the first year after the burn (21%); and then declined to 9% in the fifth year.

With the moderate burn of these ridgetop communities, litter declined; bare ground increased and then declined; and cryptogams increased from pre-burn to post-burn periods.

Light burn findings

The light burn did not affect the cover of Idaho fescue (18%) but did cause a decline in bluebunch wheatgrass composition from 13% to 3%. Prairie junegrass increased dramatically in the first year (2% to 9%) but declined to 4% in the fifth year. Sandberg's bluegrass also declined as a result of the light burn.

Litter increased to near pre-burn coverage by the fifth year after the fire. Bare ground, 21% before the burn, increased to 27% and then declined to only 3% in year five. Mosses increased dramatically to 27% after plunging to a cover of only 1% the year after the burn.

Other findings

Two of the moderately burned plots were inside the Allen Springs livestock and all-ungulate exclosures. Because the fire burned uniformly through both exclosures, and across all sampling transects, the comparison between the post-burn vegetation of both exclosures was enlightening. For brevity the all-ungulate exclosure will be referred to as "game" and the livestock-proof exclosure will be referred to as "stock."

The protective nature of the game exclosure allowed post-fire succession to take place undisturbed by grazing animals. As a result the principal bunchgrasses (Idaho fescue, prairie junegrass, and bluebunch wheatgrass) all demonstrated continued increases in occupancy of the site in the fifth year of sampling while the trend was downward in the stock exclosure where elk could graze. Interestingly, annual bromes prevailed in the game exclosure while being eliminated in the stock exclosure. This can be attributed to the desirability of the annual grasses early in the summer and also to the fact that no grazing over many years has allowed annual grasses to get established on bare ground inside the game exclosure where rodents thrive due to high litter levels. Sandberg's bluegrass (a known increaser with disturbance in these communities) was much more prevalent in the stock exclosure before (5%) and after the burn (5%) than inside the game exclosure (1%). The trafficking (trampling) by elk and deer provides less litter (18% vs. 55%) and causes more bare ground (17% vs. 5%), which in turn

gives a competitive advantage to the bluegrass for successful establishment.

It was observed that mosses tended to occupy the shaded, moister and cooler microhabitat at the bunchgrass edge. Therefore, where mosses were entwined with the bunchgrass crowns the fire tended to burn with longer duration, burn hotter, and cause greater mortality than where bunches were isolated from the moss.

Idaho fescue - prairie junegrass (ridgetops) plant association (FEID-KOCR) (n=4)

Burn Intensity	--------Moderate-------- (n=3)			--------Light------- (n=1)		
Species	**PRE**	**1**	**5**	**PRE**	**1**	**5**
Grasses						
Idaho fescue (FEID)	*25 ◆(18-29)	13 (10-17)	15 (12-21)	20	20	18
bluebunch wheatgrass (AGSP)	26 (24-28)	14 (3-20)	14 (9-17)	13	4	3
prairie junegrass (KOCR)	3 (0-6)	5 (1-8)	5 (1-9)	2	9	4
Sandberg's bluegrass (POSA3)	2 (0-5)	2 (0-5)	3 (0-9)	14	10	7
annual bromes (BROMU)	7 (3-15)	8 (0-15)	4 (0-8)	1	4	6
Perennial Forbs						
western yarrow (ACMIL)	4 (1-7)	1 (1-2)	2 (1-3)	3	1	1
arrowleaf balsamroot (BASA)	2 (1-4)	t (0-2)	t (0-1)	0	0	0
longleaf phlox (PHLO)	4 (0-5)	t (0-2)	1 (0-1)	0	0	0
silky lupine (LUSE)	6 (1-8)	4 (1-6)	5 (3-7)	2	0	0
Annual Forbs						
pale alyssum (ALAL)	1 (1-2)	6 (1-14)	1 (1-2)	0	0	0
shining chickweed (STNI)	0	7 (0-20)	1 (0-1)	0	0	0
yellow salsify (TRDU)	3 (1-5)	3 (1-4)	1 (0-1)	0	1	1
narrowleaved collomia (COLI2)	t (0-1)	1 (1-2)	1 (1-1)	0	0	1
prickly lettuce (LASE)	2 (1-3)	1 (0-1)	1 (1-2)	0	0	0
tall annual willowweed (EPPA)	1 (0-1)	t (0-1)	4 (2-7)	0	0	2
Litter	52 (25-75)	37 (26-59)	35 (18-55)	44	19	38
Bare Ground	15 (14-17)	24 (14-34)	10 (5-17)	21	27	3
Moss	11 (2-24)	7 (0-11)	13 (1-28)	19	1	27
Lichen	1 (0-1)	t (0-1)	2 (1-4)	0	0	1

* Area Coverage (%)
◆ Range of Cover (%)

FEID-KOCR (Ridgetops)

Plot 194 Established - 1963 Burned moderately - 1986 Joseph-Starvation Fire
Allen Spring Ridge (Game Exclosure), Wallowa Valley Ranger District, Wallowa-Whitman National Forest

August 1978 – Idaho fescue and bluebunch wheatgrass were co-dominant (27-28%). Sandberg's bluegrass was present at 7%; annual bromes averaged 15%. Prairie junegrass and Kentucky bluegrass averaged 6-7%. Mosses covered 24% of the ground surface.

September 1986 – The ridgetop site burned moderately. The greening shown in this mid-September view resulted from rapid sprouting by Kentucky bluegrass following light moisture availability. The game exclosure remained intact.

FEID-KOCR (Ridgetops)

August 1987 – Idaho fescue cover declined (28% to 12%); bluebunch wheatgrass declined (27% to 3%); prairie junegrass increased slightly (6% - 8%) while Kentucky bluegrass tripled in cover (7% to 21%). Annual bromes declined (15% to 10%). Moss coverage was reduced to half (24% to 11%). Chickweed flourished as an invader (20%).

May 1992 – Five years after the burn, Idaho fescue rebounded to 21%; bluebunch wheatgrass increased to 9%; and prairie junegrass remained constant (9%). Kentucky bluegrass declined to near pre-burn levels (9% cover in year 5). Annual bromes declined again to only 4% cover. Mosses remained constant (10%). Chickweed declined dramatically to 1% as tall annual willowweed invaded (7%). Essentially the moderate ridgetop burn was beneficial to bunchgrass maintenance.

Idaho fescue - prairie junegrass (high elevation) plant association (FEID-KOCR)

Three plots were selected to study the fire effects in the Idaho fescue-prairie junegrass plant association. They are on steep canyon slopes at high elevations (above 4000 ft.). The three plots were established on the Teepee Butte Burn of 1988 and prior to that event. All plots were lightly burned. They are located on steep slopes (avg.= 50%) on three differing aspects (north, east, and west) at elevations ranging from 4700 ft to 5060 ft (avg. = 4930 ft). The plots were sampled the first and fifth years after the fire.

Light burn findings

Common snowberry and rose often have minor coverages on these sites (especially in cove or concave microsites). These species responded differently to the light burn. Rose increased and snowberry declined. The decrease in snowberry could be attributed to its intolerance of slightly drier, warmer conditions resulting from the burn or from preferential browsing of new growth by elk and deer.

Idaho fescue was initially affected detrimentally by the burn (cover decreased from 38% to 18%) but then jumped to an impressive post-burn high in the fifth year (53%). Bluebunch wheatgrass followed the same trend by first declining from 12% to 9% and then doubling to 18% in the fifth year. Prairie junegrass dropped to 3% in year five and Sandberg's bluegrass went out of the community as a weak performer on steep slopes.

Perennial forbs increasing with the burn were longleaf phlox, silky lupine (11% to 41%), red avens, and harsh paintbrush. Declining from the light burn were yarrow, creamy buckwheat, twin arnica, and deerhorn. Plants remaining constant throughout the pre- and post-burn periods were arrowleaf balsamroot, red besseya, and annual bromes (cheatgrass, soft chess, and rattlesnake brome).

Over the 5-year period, litter doubled to 61% resulting in a sharp decline by mosses (28% to 4%). Bare ground, though doubling from 20% to 40% the year after the fire, returned to a coverage of 20% in year five.

Idaho fescue - prairie junegrass (high elevation) plant association (FEID-KOCR) (n=3)

Burn Intensity	Light (n=3)		
Species	**PRE**	**1**	**5**
Grasses			
Idaho fescue (FEID)	*38 ◆(19-55)	18 (10-25)	53 (15-85)
bluebunch wheatgrass (AGSP)	12 (7-15)	9 (5-13)	18 (15-20)
prairie junegrass (KOCR)	2 (0-5)	6 (3-10)	3 (0-7)
Sandberg's bluegrass (POSA3)	2 (0-5)	t (0-1)	0
annual bromes (BROMU)	5 (1-13)	9 (2-12)	4 (0-10)
Perennial Forbs			
longleaf phlox (PHLO)	1 (0-1)	1 (0-1)	6 (0-20)
silky lupine (LUSE)	11 (1-15)	1 (0-1)	41 (2-70)
harsh paintbrush (CAHI2)	1 (0-3)	3 (0-5)	7 (0-10)
western yarrow (ACMIL)	9 (6-10)	9 (1-3)	4 (0-10)
creamy buckwheat (ERHE)	5 (5-5)	3 (1-5)	2 (1-5)
red avens (GETR)	2 (0-5)	5 (0-15)	8 (1-20)
twin arnica (ARSO)	5 (1-10)	2 (1-5)	3 (1-5)
Annual Forbs			
deerhorn (CLPU)	5 (1-10)	2 (0-5)	0
Litter	30 (15-45)	28 (20-45	61 (48-70)
Bare Ground	21 (5-53)	40 (25-54)	20 (5-45)
Moss	28 (0-70)	20 (1-40)	4 (1-5)
Lichen	0	0	t (0-1)

* Average Cover (%)
◆ Range of Cover (%)

FEID-KOCR (High Elevation)
Plot 6907 Established - 1957 Burned lightly - 1988 Teepee Butte Fire
Downey Saddle, Hells Canyon NRA, Wallowa-Whitman National Forest

July 1976 – Idaho fescue, prairie junegrass, and bluebunch wheatgrass dominated the site. Sandberg's bluegrass was present (5%) along with creamy buckwheat (5%) and yarrow (6%). Snowberry and rose had increased because of severe grazing by elk and cattle over the 1957 - 1976 period.

October 1988 – Fire burned much of standing biomass, but skipped ground litter and some plants.

FEID-KOCR (High Elevation)

July 1989 – Idaho fescue and prairie junegrass both declined from pre-burn coverages; but bluebunch wheatgrass doubled (7% to 13%). Creamy buckwheat, Sandberg's bluegrass, and yarrow all declined in coverage the first year after the fire.

June 1995 – Idaho fescue and prairie junegrass rebounded to near pre-burn coverages. Making a notable increase the fifth year after the fire was bluebunch wheatgrass (20% cover). The light burn was beneficial to bunchgrass vitality and dominance.

Idaho fescue - prairie junegrass (mounds) plant association (FEID-KOCR)

Three sites with patterned ground (mounds) were used to study fire's effects on the Idaho fescue-prairie junegrass plant association. All sites contained plots that pre-existed the fire (Thomason complex 1994). Two plots represented the plant association in mid seral stage; the third plot represented an early seral stage. The plots are all on gentle ridgetops (3% - 5%) with southwesterly aspects at 4480 ft, 4560 ft, and 4570 ft in elevation. The burn on the mid-seral communities was moderate; the burn on the early-seral community was light. The plots were resampled the first year after the burn.

Moderate burn findings

In the first year after the burn, Idaho fescue declined (37% to 20%), bluebunch wheatgrass increased (5% to 17%), and Sandberg's bluegrass remained unaffected at a cover of 5%. This is a classic relationship for these three bunchgrasses where the more sensitive fescue decreases, opportunistic wheatgrass colonizes rapidly and the low statured bluegrass is unaffected by the moderate burn. Prairie junegrass remained constant following the burn. The only forbs to decrease on the plot were creamy buckwheat, red avens, and yarrow. Pioneering plants entering the site for the first time as a result of the fire were twin arnica, small-flowered fringecup, pink microsteris, swale desert-parsley, and small-flowered blue eyed Mary. Of these twin arnica, small-flowered fringecup and pink microsteris were especially prolific with coverages at 10%. Interestingly two "weedy" components of the pre-burn community decreased the first year after the burn -- Kentucky bluegrass and cheatgrass -- which had been present before the burn. Mosses declined as well from the moderate burn.

Light burn findings

This very early seral stage was dominated by creamy buckwheat (40%) in the pre-burn community. The site had degenerated from heavy overgrazing to the degree that Idaho fescue and bluebunch wheatgrass had been eliminated. Two kinds of ungulate-induced changes occurred: overuse of bunchgrasses in early summer and the warming and drying of the microhabitat from canopy loss and concurrent litter loss. This allowed Kentucky bluegrass to colonize and expand. As a result, Kentucky bluegrass increased. Apparently the light burn gave the competitive advantage to the rhizomatous bluegrass over other bunchgrasses. However annual bromes (cheatgrass and soft chess) doubled. Creamy buckwheat showed a first year decline from 40% to 15%. It will likely increase aggressively by the fifth year following the burn. Other forbs showing a post-burn decline were yarrow and deerhorn. Swale desert-parsley increased dramatically (1% to 20%) and dominated the mound the first year after the burn. Annual forbs entering the site as a result of this light burn were pink microsteris and small-flowered blue eyed Mary. Seed from plants on adjacent sites initiated germinants of bluebunch wheatgrass and prairie junegrass. Perhaps by the fifth-year sampling of this site those species will be working their way back into the community composition.

Idaho fescue - prairie junegrass (mounds) plant association (FEID-KOCR) (n=3)

Burn intensity	Moderate (n=2)		Light (n=1)	
Species	**PRE**	**1**	**PRE**	**1**
Grasses				
Idaho fescue (FEID)	*37 ◆(35-38)	20 (19-20)	0	0
bluebunch wheatgrass (AGSP)	5 (5-6)	17 (8-25)	0	1
Sandberg's bluegrass (POSA3)	5 (1-10)	5 (1-10)	1	0
prairie junegrass (KOCR)	6 (1-10)	7 (5-8)	0	1
Kentucky bluegrass (POPR)	12 (10-13)	1 (0-2)	15	20
annual bromes (BROMU)	12 (3-20)	4 (0-8)	5	10
Perennial Forbs				
creamy buckwheat (ERHE)	18 (0-35)	1 (0-3)	40	15
red avens (GETR)	20 (0-40)	15 (0-30)	0	0
yarrow (ACMIL)	6 (3-8)	2 (1-4)	15	3
twin arnica (ARSO)	0	5 (0-10)	0	0
small-flowered fringecup (LIPA)	0	5 (0-10)	0	0
swale desert-parsley (LOAM)	0	1 (0-1)	1	20
Annual Forbs				
pink microsteris (MIGR)	0	8 (6-10)	0	5
small-flowered blue eyed Mary (COPA)	0	1 (0-1)	0	15
deerhorn (CLPU)	1 (0-1)	0	40	1
Litter	22 (5-39)	15 (10-19)	1	5
Bare Ground	25 (19-30)	38 (25-51)	15	10
Moss	9 (3-15)	2 (0-3)	0	0
Lichen	0	1 (0-1)	0	0

* Average Cover (%)
◆ Range of Cover (%)

FEID-KOCR (Mounds)

Plot 139 Established - 1978 Burned moderately - 1986 Joseph-Starvation Fire
Horse Pasture Ridge, Wallowa Valley RD, Wallowa-Whitman National Forest

1978 – Bunchgrasses dominated on mounds in a mid-seral Idaho fescue - prairie junegrass community. Bluebunch wheatgrass dominated (25%) with Idaho fescue (17%) and prairie junegrass (3%) subordinate. Annual bromes averaged 35%.

1986 – This site burned moderately with all standing culms and leaves consumed.

1987 – The year after the burn, annual bromes and yarrow made a showy, aggressive increase in the bunchgrass community.

FEID-KOCR (Mounds)

Plot 191 Established - 1978 Burned moderately - 1994 Thomason Fire
Vance Knoll, Wallowa Valley RD, Wallowa-Whitman National Forest

August 1978 – Idaho fescue dominated over bluebunch wheatgrass (35% to 5%) in the pre-burn community. Red avens and creamy buckwheat were high in coverage on the mound top. Prairie junegrass provided 10% cover.

September 1994 – Fire burned moderately across the mound top, sides, and intervening swale. Some interstitial areas were missed by the fire.

June 1995 – Idaho fescue declined to 20% but bluebunch wheatgrass increased markedly to 25% becoming the dominant bunchgrass. Red avens, creamy buckwheat, and prairie junegrass all declined. Invading were twin arnica (10%) and fringecup (10%). Stature of plants was lower the first growing season after the fire influencing some low coverage percentages.

Idaho fescue - prairie junegrass (low elevation) plant association (FEID-KOCR)

Four plots were used to study fire's effects on the low-elevation (less than 4000 ft) vegetation of the Idaho fescue - prairie junegrass plant association. One plot burned severely in the Middle Point Fire of 1986. The other three plots burned moderately in the Teepee Butte Fire of 1988. All plots pre-existed the fires. In the hot, dry lower canyon these communities can only occur where aspect affords microenvironments capable of sustaining enough moisture and cooler temperatures through the summer months. Therefore these sites are all on north to northeast aspects on steep slopes (58% to 75%) with an average of 66%. The elevations ranged from 2830 ft to 2980 ft (avg.=2902 ft). The plots were resampled the first and fifth years after the burns.

Severe burn findings

Idaho fescue and bluebunch wheatgrass are the dominant bunchgrasses in later seral stages in this plant association. Idaho fescue was the most affected by this severe burn declining from 35% to 16% coverage. It rebounded to 30% cover in the fifth year following the burn. Bluebunch wheatgrass, however, was constant at 15%. Prairie junegrass increased the first year after the burn but then declined to only 1% cover by the fifth year. Other plants present in the pre-burn community that declined from the burn event were twin arnica and western hawkweed. Missouri goldenrod and field chickweed both declined dramatically in the first year and were absent by the fifth year. Plants entering the site following the burn were yarrow, Kentucky bluegrass, and Sandberg's bluegrass. The one species present before the fire that increased after the fire and five years later was white stemmed frasera. By the fifth year litter had increased from first year cover (32% to 37%); bare ground had decreased from 23% to only 3%; and cryptogams were returning to the community (9%) from a total loss after the fire.

Moderate burn findings

Idaho fescue and bluebunch wheatgrass both declined to half their pre-burn cover the year after the burn but then rebounded in the fifth year to higher coverages than their pre-burn levels. Prairie junegrass declined after the fire and was absent by the fifth year. Sandberg's bluegrass increased dramatically from 1% to 5% after the moderate burn but then was absent in year five. Annual bromes (cheatgrass, rattlesnake brome, and Japanese brome) maintained a constant cover throughout the pre- and post-burn periods. Other plants were scant in these communities. The only annual forb to capitalize on the burn event was common speedwell.

Litter declined the first year after the fire but then dramatically increased to 78% in year five. The initial increase in bare ground on the site (18% to 34%) declined to just 13% by the fifth year. Mosses and lichens, which were a large component of the pre-burn community (29%), declined to 12% after the fire and continued to decline with the increase in litter to only 7% in year five.

In the severely burned site, mosses were often entwined with bunchgrass bases. This allowed some fescue plants to burn longer (smoldering) and for the heat to penetrate deeper into the crowns. The result was mortality of those plants. Of all Idaho fescue sites sampled in this study following fires, the greatest mortality of fescue plants occurred in the communities of this plant association where grass density was highest and associated herbaceous cover was also high. Two plants pioneering the first year after these intense burns, but absent by the fifth year, were mountain tansy mustard and tumblemustard.

Idaho fescue - prairie junegrass (low elevation) plant association (FEID-KOCR) (n=4)

Burn Intensity	Severe (n=1)			Moderate (n=3)		
Species	**PRE**	**1**	**5**	**PRE**	**1**	**5**
Grasses						
Idaho fescue (FEID)	*35	16	30	16 ◆(15-17)	9 (7-11)	27 (12-37)
bluebunch wheatgrass (AGSP)	15	14	15	21 (19-22)	11 (8-14)	23 (16-31)
prairie junegrass (KOCR)	5	8	1	2 (0-3)	1 (0-2)	0
Kentucky bluegrass (POPR)	0	0	1	0	0	0
Sandberg's bluegrass (POSA3)	0	0	1	1 (0-1)	5 (1-8)	0
annual bromes (BROMU)	0	0	0	2 (1-3)	2 (1-4)	1 (1-2)
Perennial Forbs						
twin arnica (ARSO)	20	0	1	t (0-1)	t (0-1)	0
western hawkweed (HIAL2)	5	3	2	0	0	0
Missouri goldenrod (SOMI)	20	1	0	0	0	0
western yarrow (ACMIL)	0	2	1	3 (1-5)	2 (1-2)	1 (0-1)
white stemmed frasera (FRAL2)	1	3	5	0	0	0
Annual Forbs						
field chickweed (CEAR)	10	2	0	0	0	0
common speedwell (VEAR)	0	0	0	1 (0-1)	1 (0-2)	3 (0-6)
Litter	25	32	37	48 (41-54)	33 (30-39)	78 (68-88)
Bare Ground	0	23	3	18 (6-32)	34 (22-40)	13 (4-18)
Moss	40	0	6	22 (7-41)	6 (1-11)	5 (2-7)
Lichen	0	0	3	7 (0-16)	6 (3-8)	2 (1-3)

* Average Cover (%)
◆ Range of Cover (%)

FEID-KOCR (Low Elevation)

Plot 1108 Established - 1984 Burned severely - 1986 Sheep Divide Fire
Middle Point Ridge, Hells Canyon NRA, Wallowa-Whitman National Forest

May 1984 – Idaho fescue clearly dominated (35%) over bluebunch wheatgrass (15%) and prairie junegrass (5%). Forbs present in high coverage were twin arnica (20%), goldenrod (20%), and chickweed (10%). Use by deer, elk, and cattle influenced the plant composition.

September 1986 – The site was burned severely with some terracettes being "undermined" by burning of litter and duff.

FEID-KOCR (Low Elevation)

June 1987 – Idaho fescue declined; prairie junegrass increased to 8%; and bluebunch wheatgrass remained constant. Twin arnica, goldenrod, and chickweed all declined dramatically the first growing season after the fire from pre-burn levels. Bare ground constituted about 25% of the plot area.

May 1992 – Idaho fescue had rebounded to pre-burn cover (30%); bluebunch wheatgrass remained at 15%; prairie junegrass declined to only 1%. Twin arnica was present at 1%. Chickweed and goldenrod had left the community. Bare ground was now at only 3% cover. Mosses and lichens recovered to 9%.

Idaho fescue - bluebunch wheatgrass - silky lupine plant association (FEID-AGSP-LUSE)

One plot used to study fire's effects in this plant association existed prior to the Joseph-Starvation Fire of 1986. It was resampled the first and fifth years after the burn. The plot is on a northeast-facing slope (55%) at an elevation of 4300 ft. The site burned moderately.

Moderate burn findings

The two primary bunchgrasses declined with the fire event. Idaho fescue declined more rapidly; bluebunch wheatgrass also declined but less dramatically and tended to hold its occupancy better. Idaho fescue cover changed from 10% in the pre-burn community to 8% the year after the burn and to only 2% in the fifth year. Bluebunch wheatgrass declined from 28% to 24% to 12% over the sampling periods. Annual bromes increased dramatically (cheatgrass, rattlesnake brome, soft chess, and rattlesnake brome) to 31% in the fifth year. Sandberg's bluegrass and yarrow were constant over the period. Entering the sites as pioneers were tall annual willowweed, pale alyssum, and deerhorn. Perennial forbs declining over the period were silky lupine and arrowleaf balsamroot. Creamy buckwheat declined the year after the burn but was increasing by year five.

Litter first declined and then increased; bare ground declined from pre-burn to post-burn; and cryptogam cover increased by the fifth year after the burn.

Idaho fescue - bluebunch wheatgrass - silky lupine plant association (FEID-AGSP-LUSE) (n=1)

Burn Intensity	Moderate (n=1)		
Species	**PRE**	**1**	**5**
Grasses			
Idaho fescue (FEID)	*10	8	2
bluebunch wheatgrass (AGSP)	28	24	12
Sandberg's bluegrass (POSA3)	2	3	1
annual bromes (BROMU)	3	4	31
Perennial Forbs			
western yarrow (ACMIL)	4	3	6
creamy buckwheat (ERHE)	5	2	7
silky lupine (LUSE)	11	2	2
arrowleaf balsamroot (BASA)	3	2	1
Annual Forbs			
tall annual willowweed (EPPA)	0	0	1
pale alyssum (ALAL)	0	0	1
deerhorn (CLPU)	0	0	1
Litter	28	23	32
Bare Ground	29	25	3
Moss	1	1	2
Lichen	1	0	3

* Average Cover (%)

FEID-AGSP-LUSE

Plot 678 **Established - 1981** **Burned moderately** **Teepee Butte Fire**
Cold Spring Ridge, Hells Canyon NRA, Wallowa-Whitman National Forest

1981 – The mid-seral community was dominated by bluebunch wheatgrass with Idaho fescue associated. Forbs present were arrowleaf balsamroot, silky lupine, deerhorn, and yarrow.

1988 – The fire burned moderately leaving some grass tufts uncharred. The area between vegetation patches and bunchgrass tufts was unburned.

1989 – The first year after the burn, bluebunch wheatgrass and Idaho fescue are vigorous and approaching pre-burn abundance. Balsamroot retained the same cover and was not affected by the burn. Prominent forbs are yarrow, death camas, and harsh paintbrush. The overall composition is about the same as before the burn. Bunchgrass vigor and vitality improved from the burn.

FEID-AGSP-LUSE

Plot 123 **Established - 1979** **Burned moderately - 1986** **Joseph-Starvation Fire**
Horse Pasture Ridge, Wallowa Valley Ranger District, Wallowa-Whitman National Forest

July 1979 – Bluebunch wheatgrass dominated (28%) with Idaho fescue and Sandberg's bluegrass associated at 10% and 2% respectively. Silky lupine cover was 11% before the fire. Creamy buckwheat (5%), yarrow (4%), and arrowleaf balsamroot (3%) were principal forbs in the community. Annual bromes accounted for only 3% cover.

September 1986 – All standing biomass was consumed; litter and ground cover was basically unburned.

June 1987 – Bluebunch wheatgrass remained the dominant plant at near pre-burn levels (24%). Idaho fescue and Sandberg's bluegrass remained constant. Silky lupine declined dramatically to 2%. Creamy buckwheat dropped to 2%; yarrow decreased to 3%; and arrowleaf balsamroot declined to 2%. Annual bromes were constant at 4%. Bare ground covered 25% of the area.

June 1992 – Five years after the fire, bluebunch wheatgrass had declined to only 12% cover; Idaho fescue dropped to 2% and Sandberg's bluegrass was only present at 1%. Silky lupine and balsamroot were constant at low coverage levels. Increasing on the site were creamy buckwheat (7%), yarrow (6%), and annual bromes (31%). The decline in bunchgrasses and increase in bromes was probably a result of ungulate grazing pressure (elk, cattle) rather than a natural successional phenomenon.

Idaho fescue - bluebunch wheatgrass - arrowleaf balsamroot plant association (FEID-AGSP-BASA)

Four plots were used to study the fire effects to vegetation in this plant association. Two plots pre-dated the Joseph-Starvation Burn of 1986; one fire pre-dated the Teepee Butte Burn of 1988; and one plot was established after the Gould Gulch Burn of 1986. All plots were resampled the first and fifth years after the fires. One plot burned severely; 2 plots burned moderately; and one plot burned lightly. All plots are on either southeasterly or southwesterly aspects and occur on steep slopes (30% to 40%) with an average of 36%. Elevations range from 4000 to 5100 ft (avg.= 4475 ft).

Severe burn findings

Vegetation of this plant association is typified by a union of plants typically found on drier, warmer sites than where Idaho fescue - bluebunch wheatgrass - silky lupine communities can persist. Arrowleaf balsamroot may or may not, be part of the "union." In the case of this severely burned plot on Joseph-Starvation burn, arrowleaf balsamroot was not part of the pre- or post-burn communities. The three principal bunchgrasses of this type all showed declines from the severe burn. Idaho fescue declined slightly; bluebunch wheatgrass declined from 35% to 17%; and Sandberg's bluegrass declined from 10% to 5%. Increasing as a result of the burn on this southerly slope were annual bromes (cheatgrass, Japanese brome, and rattlesnake brome); tall annual willowweed; blepharipappus; and lomatiums (swale desert-parsley, nine-leaf lomatium). Annuals constituted those plants entering the community as a result of the burn. Among the annual forbs capitalizing on the severe burn were pale allysum, deerhorn, prickly lettuce, pink microsteris, and skullcap.

Litter declined in the first year after the burn and increased in the fifth year to 26%. Bare ground conversely increased in the first year after the burn (20% to 48%) but then declined to 11%. Mosses and lichens entered the post-burn community in the fifth year at 8% cover.

Moderate burn findings

The two principal bunchgrasses (Idaho fescue and bluebunch wheatgrass) declined slightly as a result of the moderate burn. Sandberg's bluegrass was constant at 5% over the period. Arrowleaf balsamroot declined in cover from 9% to 1% the fifth year after the burn. Plants increasing as a result of the burn were yarrow, tall annual willow herb, and blepharipappus. Plants entering the community as a result of the burn were pale alyssum, pink microsteris, and yellow salsify. Annual bromes were explosive on the Fire Ridge plot with a fifth year entry at 8% cover. Four different bromes were involved (cheatgrass, soft chess, rattlesnake brome, and Japanese brome). By the fifth year after the burns, bare ground had declined and cryptogams had increased to 16% cover.

Light burn findings

Bluebunch wheatgrass responded in the fifth year by rebounding to nearly its pre-burn coverage of 24%. Idaho fescue doubled from a pre-burn coverage of 6% to a fifth year coverage of 12%. Arrowleaf balsamroot coverage drastically declined from a pre-burn cover of 10% to only 1% in the fifth year. Sandberg's bluegrass declined from 6% to 3% the first year after the burn and then was absent by year five. Plants maintaining a consistent cover throughout the pre- to post-burn periods were yarrow and lupine. Annual bromes were relatively constant at low coverage after five years. Plants entering the community as a result of this light burn were pale alyssum, deerhorn, tall annual willowweed, and pink microsteris. Over the 5 year period, litter increased; bare ground declined; and cryptogams maintained a constancy at 2%.

Summary

Fire intensities affected the bunchgrasses differently. Bluebunch wheatgrass was most affected by the severe burn and least affected by the light burn. Idaho fescue, on the other hand, was constant with only slight declines from the severe and moderate burns but doubled with the light fire. Sandberg's bluegrass cover was erratic in response to the burns. It declined with the severe burn, remained constant with the moderate burn, but was eliminated by the light burn! Predictably the annual bromes invaded or increased

dramatically along with a host of annual forbs in the severely burned site and were least effective as colonizers in the light burn. Litter increases were greatest in the light burn. Mosses and lichens tended to colonize best following the severe burn.

Wildlife use was attributed to the fifth year decline by bluebunch wheatgrass and Idaho fescue from first year levels in the severely burned plot.

Idaho fescue - bluebunch wheatgrass - arrowleaf balsamroot (FEID-AGSP-BASA) (n=4)

Burn Intensity	Severe (n=1)			Moderate * (n=2)			Light (n=1)		
Species	**PRE**	**1**	**5**	**PRE**	**1**	**5**	**PRE**	**1**	**5**
Grasses									
Idaho fescue (FEID)	*5	6	3	4	3 ◆(1-5)	2 (1-3)	6	6	12
bluebunch wheatgrass (AGSP)	35	30	17	16	11 (10-12)	8 (8-9)	24	7	22
Sandberg's bluegrass (POSA3)	10	6	5	5	8 (8-9)	5 (5-6)	6	3	0
annual bromes (BROMU)	3	3	9	0	0	4 (0-8)	5	6	3
Perennial Forbs									
lomatiums (LOAM, LOTR)	1	1	2	1	0	1 (1-2)	3	1	1
narrow-leaved skullcap (SCAN)	0	1	1	1	0	1 (0-1)	2	3	1
arrowleaf balsamroot (BASA)	0	0	0	9	5 (4-6)	1 (0-2)	10	1	1
western yarrow (ACMIL)	1	1	1	1	0	2 (2-2)	3	1	4
silky lupine (LUSE)	0	0	0	1	0	1 (0-1)	2	1	2
Annual Forbs									
tall annual willowweed (EPPA)	1	1	8	1	0	9 (1-18)	0	2	3
blepharipappus (BLSC)	1	1	3	1	0	3 (0-5)	0	0	0
pale allysum (ALAL)	0	1	1	0	0	1 (0-1)	0	1	1
deerhorn (CLPU)	0	0	1	1	0	1 (0-1)	0	2	0
prickly lettuce (LASE)	0	1	4	1	0	1 (0-1)	1	0	1
pink microsteris (MIGR)	0	0	1	0	0	1 (1-1)	0	1	2
yellow salsify (TRDU)	1	0	1	0	0	1 (0-1)	1	1	1
Litter	20	11	26	36	No	32	15	7	44
Bare Ground	20	48	11	31	Data	14	44	53	35
Moss	0	0	4	5		10	1	1	1
Lichen	0	0	4	0		6	0	0	1

* - Average for pre-burn derived from 1 plot
* Average Cover (%)
◆ Range of Cover (%)

FEID-AGSP-BASA

Plot 633 **Established - 1981** **Burned moderately - 1986** **Joseph-Starvation Fire**
Davis Creek Canyon, Wallowa Valley Ranger District, Wallowa-Whitman National Forest

July 1981 – Bluebunch wheatgrass dominated (16%) with Sandberg's bluegrass and Idaho fescue subordinate at 5%. Arrowleaf balsamroot was prominent at 9%.

October 1986 – Fall moisture provided rapid "greening" by the sprouting vegetation following the moderate burn. Most standing biomass had been consumed by the fire.

June 1987 – Bluebunch wheatgrass dominated after the fire (12%). Idaho fescue remained constant at 5% but Sandberg's bluegrass doubled its cover to 9%. Arrowleaf balsamroot declined to 6%.

June 1992 – By the fifth year following the fire, the dominant plant was tall annual willowweed (18%). Bluebunch wheatgrass was still the dominant bunchgrass (8%) but it had declined as had Idaho fescue (3%) and Sandberg's bluegrass (6%). Arrowleaf balsamroot also had diminished. The increase in annuals (blepharipappus and willowweed) coupled with a decline in bunchgrasses can probably be attributed to the combined use by cattle and elk.

Idaho fescue - bluebunch wheatgrass - Snake River phlox plant association (FEID-AGSP-PHCO2)

One plot located on Middle Point overlooking the Imnaha River was used to study fire's effects on vegetation pertaining to this plant association. The site was moderately burned by the Middle Point Fire of 1986. It is located on a steep (65%) northeast exposure at 2890 ft in elevation. The plot pre-dated the fire and was resampled the first and fifth years following the burn.

Moderate burn findings

The fire caused a decline in cover by bluebunch wheatgrass from a pre-burn cover of 20% to a fifth-year cover of 10%. Idaho fescue maintained its pre-burn cover of 10% with little effect by the burn. Entering the community after the burn at low coverages were prairie junegrass, Sandberg's bluegrass, and cheatgrass. Snake River phlox, the indicator forb of the association, remained constant throughout the pre- and post-burn periods. Other forbs remaining constant from this light burn were yarrow, tapertip hawksbeard, and penstemon. Forbs that entered following the burn were blepharipappus, prickly lettuce, and skullcap. Litter increased dramatically from a pre-burn cover of 5% to a fifth-year cover of 22%. Bare ground cover was 9% the first year after the fire but returned to a pre-burn level of 1% by the fifth year. Occupying much of the ground surface in the pre-burn community were mosses and lichens (70%). The fire was detrimental to the cryptogams. By the fifth year mosses and lichens accounted for a cover of 35%.

Summary

This plot represented a late seral stage of development for the community prior to the burn. The burn was moderate owing to the spatial separation of the bunchgrasses common to the dry, lithic sites of this type. However, fire burned hot about the bases of the bluebunch wheatgrass plants where mosses were collected about the crowns. This allowed fire to kill more wheatgrasses in relation to the fescue as a result. In addition, the location of bunchgrasses on the exterior side of *terracettes concentrated the fire on those portions resulting in intense burning of the duff. The result was a "shelving" left by the concave burning of the underside of the terracette.

Additionally, the loss of the bunchgrass foliar cover allowed the site to further heat and desiccate, which was detrimental to the maintenance of the moss mat. As a combined result of killing by fire's heat and climatic heat, moss cover declined precipitously from 60% to only 7%. Lichens, on the other hand, occupied the interspaces between the bunchgrasses and were unaffected by the burn with a resulting three-fold increase on the site in year five (10% to 28%).

* Terracettes are step-like formations on steep bunchgrass slopes created by surface soil creep. They may be accentuated in their development by large animals.

Idaho fescue - bluebunch wheatgrass - Snake River phlox plant association (FEID-AGSP-PHCO2) (n=1)

Burn Intensity	Light (n=1)		
Species	**PRE**	**1**	**5**
Grasses			
bluebunch wheatgrass (AGSP)	*20	9	10
Idaho fescue (FEID)	10	10	9
prairie junegrass (KOCR)	0	1	1
Sandberg's bluegrass (POSA3)	0	1	1
cheatgrass (BRTE)	0	1	3
Perennial Forbs			
Snake River phlox (PHCO2)	1	0	1
western yarrow (ACMIL)	3	1	2
tapertip hawksbeard (CRAC)	1	1	1
penstemon (PENST)	1	1	1
narrowleaved skullcap (SCAN)	0	1	1
Annual Forbs			
blepharipappus (BLSC)	0	0	1
prickly lettuce (LASE)	0	0	1
Litter	5	1	22
Bare Ground	1	9	1
Moss	60	>57<	7
Lichen	10	>57<	28

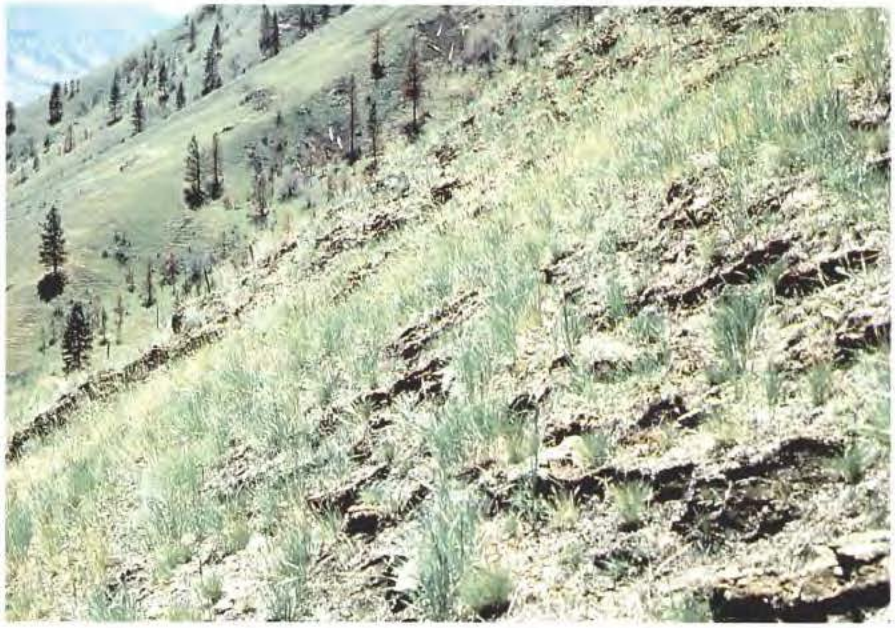
* Average Cover (%)

FEID-AGSP-PHCO2

Plot 1107 **Established - 1984** **Burned moderately - 1986** **Sheep Divide Fire**
Middle Point Ridge, Hells Canyon NRA, Wallowa-Whitman National Forest

May 1984 – Bluebunch wheatgrass was dominant over Idaho fescue (20% to 10%). Mosses and lichens were very prominent at 70%!

September 1986 – The site was moderately burned. Bunchgrass bases were uncharred. Note the "shelves" created by the fire where mosses and bunchgrasses (particularly bluebunch wheatgrass) provided fuels for intense burning into the duff.



June 1987 – Idaho fescue remained constant at 10% and became the dominant bunchgrass on the site when bluebunch wheatgrass declined to 9%. Note the shelving with sharp edges at the ground surface and darkened concavities where the duff was consumed.

May 1992 – Idaho fescue and bluebunch were co-dominant at 10% cover the fifth year after the fire. Bare ground dramatically declined as litter cover increased to 22%. Mosses and lichens were sharply reduced from pre-burn levels (70% to 35%).

Western juniper/mountain-mahogany/bluebunch wheatgrass plant association (JUOC/CELE/AGSP)

Two plots were installed on a severely burned site and a moderately burned site following the Eagle Fire of 1986. One plot was established on an east-facing 10% slope at 4550 ft elevation. The other plot was placed on a south-facing 60% slope at 4540 ft elevation. The plots were sampled the first and fifth years after the burn.

Severe burn findings

The juniper and mahogany were killed by crown fire.

Mountain snowberry resprouted and increased from 2% to 10% over the five year period. Gray and green rabbitbrushes had entered the site as pioneers on intensely burned areas by the fifth year.

Pinegrass increased on the fringes of the plot from adjacent ponderosa pine-Douglas-fir forest. Bluebunch wheatgrass was slow to respond and was not found in first-year samples. By the fifth year the wheatgrass was present at 11% cover. Also occupying the site for the first time in year five were annual bromes (cheatgrass and soft chess). Other herbaceous pioneers on the site were yarrow, prickly lettuce, bull thistle, Douglas' knotweed, Idaho fescue, western fescue, and yellow salsify.

Over the five-year period litter increased (7% to 78%) and bare ground decreased (90% to 15%). Moss was present at only 1% cover.

Moderate burn findings

The fire killed juniper and mountain-mahogany on the plot. The first-year sampling found no juniper seedlings, but mountain-mahogany responded the first year with germinants which were still present in the fifth year. Juniper was germinating on the site in the 5th year as well.

Also rapidly responding to the bare mineral soil exposed by the fire were green rabbitbrush and mountain snowberry.

Bluebunch wheatgrass was present the first year after the fire and increased to 8% cover by the fifth year. Annual bromes (cheatgrass and soft chess) were also quick to respond (2% cover in year one; 24% cover by year five). Other pioneers present on the plot were yarrow, prickly lettuce, houndstongue, bull thistle, Douglas' knotweed, western fescue, and salsify.

Over the five-year period litter increased (34% to 73%) and bare ground decreased (64% to 16%). Moss was present at only 1% cover.

Other findings

Intermediate wheatgrass was seeded on these two sites. Both sites showed increases in coverage of this exotic (8% and 11%) by the fifth year.

Summary

Both juniper and mountain-mahogany are vulnerable to mortality from moderate and severe burning. Observations made in Blue Mountain burns show that a light burn often promotes germination of mountain-mahogany. Perhaps with normal fire periodicity the concern for vitality of this species may be reduced. A comparison between the severe and moderate burns showed 36% of the species in year five were present in year one on the severe burned area, while 61% of the year 5 species were present in year one following the moderate burn. Thus the shock of the higher intensity burn was greater to the site.

Western juniper/mountain-mahogany/bluebunch wheatgrass plant association (JUOC/CELE/AGSP) (n=2)

Burn Intensity	-----Severe----- (n=1)		-----Moderate---- (n=1)	
Species	**1**	**5**	**1**	**5**
Trees				
western juniper (JUOC)	*0	0	0	1
Shrubs				
mountain-mahogany (CELE)	0	0	1	1
mountain snowberry (SYOR)	2	10	1	1
rabbitbrush (CHNA, CHVI)	0	2	1	3
Grasses				
pinegrass (CARU)	1	4	1	1
bluebunch wheatgrass (AGSP)	0	11	1	8
annual bromes (BROMU)	0	24	2	24
Idaho fescue (FEID)	0	1	0	0
western fescue (FESC)	0	1	1	1
Perennial Forbs				
western yarrow (ACMIL)	1	1	1	1
Annual Forbs				
prickly lettuce (LASE)	0	1	0	1
yellow salsify (TRDU)	0	1	0	1
houndstongue (CYOF)	0	0	0	1
Douglas' knotweed (PODO)	1	1	0	1
Litter	7	78	34	73
Bare Ground	90	15	64	16
Moss	0	1	0	1
Lichen	0	0	0	0

* Average Cover (%)

Ninebark-common snowberry plant association (PHMA-SYAL)

The Joseph-Starvation Fire of 1986 burned many stringers of Douglas-fir/ninebark and ninebark-common snowberry communities. One of the pre-existing plots burned severely and was chosen for this fire effects study. The plot is located with a northwest aspect on a 67% slope at 4530 ft elevation. It was resampled in the first and fifth years following the fire.

Severe burn findings

These stringers have evolved with fire-resilient vegetation. Ninebark, spiraea, and snowberry responded by sprouting from blackened root crowns the year after the burn. However, as ninebark cover increased, snowberry and spiraea declined slightly. After five years the shrubland was again dominated by ninebark; almost back to its pre-burn coverage by the species. Serviceberry, present at 10% in the pre-burn community, didn't fare as well. It was only occupying 1% of the area in year five.

A key pre-burn component at 40% cover, pinegrass steadily increased from the first year through the fifth year from rhizomes and seeded germinants. By the fifth year it had rebounded to 23% cover. Pioneers entering the burned area the first year after the fire were miner's lettuce, threadleaf phacelia, cheatgrass, rattlesnake brome, and tumblemustard. All had declined on the plot by the fifth year except for miner's lettuce. Plants entering the site in the fifth year of post-fire succession were tall annual willowweed, prickly lettuce, heartleaf arnica, yarrow, and prairie junegrass. Plants present in all years (pre-burn and post-burn) were bluebunch wheatgrass, cleavers, Idaho fescue, and varileaf phacelia.

Litter increased from 25% the first year to 47% the fifth year. The year after the burn, bare ground was sampled at 25% of the area. By the fifth year it had dropped to 9%. Mosses were again present at pre-burn coverage amounts by the fifth year.

Other findings

Brittle bladder fern is very susceptible to fire. It was present in the re-burn community at 5% cover. It was killed by this fire.

Ninebark sprouted profusely a year after the burn sending up 18-24" leaders. Common snowberry, birchleaf spiraea, and pinegrass were vigorous sprouters the year after the burn. Tumblemustard was an opportunist achieving 20% cover on the site the first year after the burn. Winter wheat seeded in nearby forest sites made a 5% presence on the site the first year from aerial seeding drift. It was gone from the site by the fifth year.

Ninebark - common snowberry plant association (PHMA-SYAL) (n=1)

Burn Intensity	-----Severe----- (n=1)		
Species	**PRE**	**1**	**5**
Shrubs			
ninebark (PHMA)	*80	45	68
common snowberry (SYAL)	40	10	5
birchleaf spiraea (SPBE)	0	5	1
serviceberry (AMAL)	10	1	1
Grasses			
bluebunch wheatgrass (AGSP)	5	1	2
Idaho fescue (FEID)	5	1	1
prairie junegrass (KOCR)	0	0	1
pinegrass (CARU)	40	15	23
annual bromes (BROMU)	0	5	5
Perennial Forbs			
heartleaf arnica (ARCO)	20	0	4
western yarrow (ACMIL)	1	0	1
varileaf phacelia (PHHE)	1	5	1
Annual Forbs			
prickly lettuce (LASE)	0	0	1
threadleaf phacelia (PHLI)	0	3	1
tumblemustard (SIAL)	0	20	1
tall annual willowweed (EPPA)	0	0	1
miner's lettuce (MOPE)	0	1	5
cleavers (GAAP)	10	1	1
Litter	90	25	47
Bare Ground	0	25	9
Moss	1	0	1
Lichen	0	0	0

* Average Cover (%)

PHMA-SYAL

Plot 118 **Established - 1978** **Burned severely - 1986** **Joseph-Starvation Fire**
Horse Pasture Ridge, Wallowa Valley RD, Wallowa-Whitman National Forest

July 1978 – The pre-burn community was dominated by ninebark (80%), common snowberry (40%), pinegrass (20%), and heartleaf arnica (20%).

September 1986 – The site was burned severely with all standing biomass consumed. The density of shrub, grass, and forb vegetation provided abundant light- and moderate-sized fuels.

PHMA-SYAL

August 1987– Ninebark cover was reduced by 50% and snowberry by 75%. The shrubs resprouted from shrub bases and rhizomes the first year after the fire. Pinegrass responded (15%) as did annual bromes (5%). Heartleaf arnica was absent. Tumblemustard was the dominant herbaceous plant (20%).

June 1992 – Ninebark cover increased to 68% (almost to pre-burn level). Snowberry declined to 5%. Pinegrass increased to 23%. Heartleaf arnica returned (4%). Tumblemustard, prominent the first year after the burn, had declined by the fifth year to 1%. Annual bromes remained constant at 5%.

Common snowberry - rose plant association (SYAL-ROSA)

The Pleasant Valley Exclosures were constructed in 1971. They encompass snowberry - rose communities that were burned moderately by a human-caused fire in 1985. Transects had been established prior to the completion of the exclosures. They were first sampled in 1969. They were resampled in 1983 prior to the 1985 fire. Then following the fire the transects were sampled the first year after the burn (1986); and again 10 years later in 1996.

The ungulate-proof (GAME) exclosure is located on a 15% east-facing slope at 2530 ft elevation. The comparative livestock-proof (STOCK) exclosure is located on a 20% east-facing slope at 2620 ft elevation. The community in the GAME exclosure had succeeded in the absence of disturbance (fire, grazing, and browsing animals) to a late seral stage of development where snowberry and rose dominated. The STOCK exclosure, with continued grazing pressure from wild ungulates and lack of fire, had achieved an early-mid seral stage of development where mid-seral grasses dominated and shrubs were still repressed.

Moderate burn findings

Late seral vegetation burned in the GAME exclosure.

Snowberry and rose combined for a coverage of 75% prior to the burn. The first year after the burn they covered just 20% of the area. Annual herbs now dominated. The occupancy was by thymeleaf sandwort, yellow salsify, annual bromes (cheatgrass, rattlesnake brome, hairy chess), cleavers, prickly lettuce, and American vetch. The sandwort cover was 38%, annual bromes accounted for 10%, and salsify cover was at 12%. Plants entering the site in the first year following the fire were yarrow (10% cover), salsify (12% cover), Kentucky bluegrass, moth mullein, and bluebunch wheatgrass.

By the tenth year following the burn, snowberry and rose had increased to a combined coverage of 44%. Other increases in cover were by arrowleaf balsamroot, silky lupine, cleavers, and prickly lettuce. Some plants present in the pre-burn community (not found in the first-year samples) returned and were prominent by the tenth year. These included goatweed and miner's lettuce. Plants leaving the community from the post-burn community by the tenth year were yellow hawkweed, salsify, moth mullein, Kentucky bluegrass, and American vetch. Declining by the tenth year were yarrow and thymeleaf sandwort (38% in year one to a trace in year ten). A few plants entering the community since the first year that were prominent in year 10 were chervil and white plectritis.

Litter cover returned to pre-burn levels. Bare ground had never been high in cover, was absent by year 10, and was now covered by mosses!

Moderate burn findings

Early-mid seral vegetation burned in the STOCK exclosure.

Snowberry had been repressed from this community by browsing ungulates prior to the burn. Rose plants were sparse in the pre-burn grass-dominated community. The aggressive Kentucky bluegrass mats kept the other plants in remission. Bluegrass dominated the stock exclosure (43% cover) with silky lupine providing the only other cover in double digits (11%).

Following the burn, the first year response showed a meager increase by rose, and a dominance by annuals: thyme leaf sandwort (65%), annual bromes (9%), yellow salsify, and field chickweed. Perennial herbs that were prominent were silky lupine (increased from 11% to 20%), false gromwell (increased from 3% to 9%), and yarrow (increased from 5% to 13%). Kentucky bluegrass was the dominant perennial at 35% cover.

Ten years later shrubs were still repressed. Rose was back to 1% cover; snowberry was essentially absent. Kentucky bluegrass was still the dominant herb at 32% cover. Increasing from pre-burn community levels were bluebunch wheatgrass (2% to 18%), annual bromes (3% to 12%), and goatweed (1% to 3%). Plants no longer in the community by the tenth year were thyme leaf sandwort, prickly lettuce, and field chickweed (all annuals that pioneered the site immediately after the burn). Declining by the

tenth year from previous sampling were yarrow, false gromwell, silky lupine, and yellow salsify.

By year 10 litter had regained its high coverage of the ground surface (98%), bareground was only 1%, and moss cover was only a trace.

Other findings

In the GAME exclosure (late seral community), rose was the initial beneficiary of the burn in its competition with snowberry. Two plants that increased their occupancy of this community from pre-burn to tenth year were miner's lettuce and cleavers. Together they increased from 4% to 20% coverage from the pre-burn community.

Sheep historically had grazed the benchlands of Pleasant Valley until 1971. Their use of the site was heavy and sustained each grazing season. Following the construction of the exclosures in 1971, cattle grazed for only two seasons (1975-76). Today the allotment is vacant of livestock use. However, increasing elk populations have added a new dimension to the grazing within the STOCK exclosure. Now, the benches of the Snake River canyon are available year-round to a wild ungulate that is basically an herbaceous grazer. With the removal of livestock and the increase in elk there has been a resultant increase in use of these communities repetitively year-after-year during the late winter and early spring. This use occurs when these sites are most vulnerable from a plant development point of view and when soils are easily exposed from trampling. As a result there has been a dramatic invasion by a native annual bedstraw that has occupied the interspaces between bunchgrasses and other perennial plants to such density as to preclude any germination by other plants. This perennial plant is "small bedstraw" (*Galium trifidum*). It was not found in any prior sampling at this site. In the tenth-year sampling of the STOCK exclosure, small bedstraw was found with a coverage of 27% ! This species, which entwines the other plants, may be more inhibiting to their vitality than the stoloniferous mats of Kentucky bluegrass. It also provides a deep, dense litter between bunchgrass plants, which could increase future burn severities.

Common snowberry - rose plant association (SYAL-ROSA) (n=2)

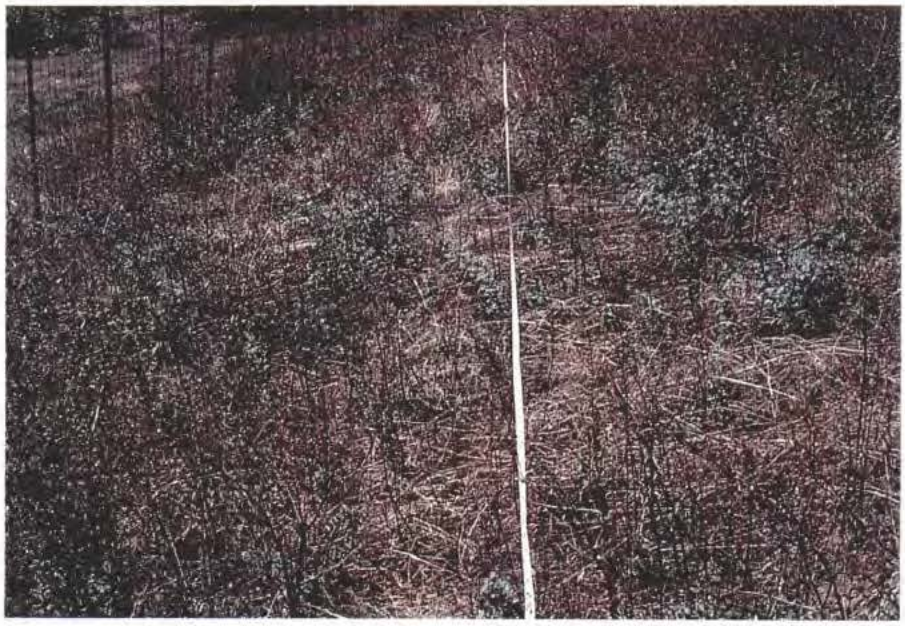
Burn Intensity	Game Exclosure Moderate (n=1)			Stock Exclosure Moderate (n=1)		
Species	**PRE**	**1**	**5**	**PRE**	**1**	**5**
Shrubs						
common snowberry (SYAL)	***65**	**4**	**31**	0	0	0
rose (ROSA)	**10**	**16**	**13**	1	2	1
Grasses						
bluebunch wheatgrass (AGSP)	**0**	**5**	**6**	2	3	18
Kentucky bluegrass (POPR)	**0**	**7**	**0**	43	35	32
annual bromes (BROMU)	**2**	**10**	**11**	3	9	12
Perennial Forbs						
western yarrow (ACMIL)	**0**	**10**	**3**	5	13	1
moth mullein (VEBL)	**0**	**3**	**0**	0	0	0
arrowleaf balsamroot (BASA)	**3**	**1**	**7**	1	1	0
silky lupine (LUSE)	**3**	**5**	**12**	11	20	5
goatweed (HYPE)	**10**	**0**	**9**	1	0	3
false gromwell (LIRU)	**1**	**1**	**0**	3	9	1
American vetch (VIAM)	**1**	**8**	**0**	0	0	6
Annual Forbs						
yellow salsify (TRDU)	**0**	**12**	**0**	0	2	1
cleavers (GAAP)	**3**	**3**	**12**	0	0	t
prickly lettuce (LASE)	**1**	**1**	**4**	1	t	0
thymeleaf sandwort (ARSE)	**1**	**38**	**t**	1	65	0
miner's lettuce (MOPE)	**1**	**0**	**8**	0	0	0
chervil (ANSC2)	**0**	**0**	**10**	0	0	0
white plectritis (PLMA3)	**0**	**0**	**5**	0	0	0
field chickweed (CEAR)	**0**	**0**	**0**	3	3	0
Litter	**93**	**0**	**95**	86	No	98
Bare Ground	**4**	**2**	**0**	0	Data	1
Moss	**0**	**0**	**3**	9		t
Lichen	**0**	**0**	**0**	0		0

* Average Cover (%)

SYAL-ROSA

Plot 747 **Established - 1982** **Burned moderately - 1985**
Pleasant Valley Exclosure (GAME), Hells Canyon NRA, Wallowa-Whitman National Forest

June 1983 – Shrubs (common snowberry, rose) totally dominated the community (75% cover). Goatweed was a prominent forb (10%), but cleavers was the most common herb (32%).



August 1985 - The moderate burn left standing stems of snowberry and rose in an otherwise "clean" burn of the site.

SYAL-ROSA

June 1986 – Where snowberry had dominated over rose (65% to 10%) in the pre-burn community, the dominance was reversed the first year after the fire. Rose increased over snowberry (16% to 4%). Annual vegetation was dominant over perennials led by thymeleaf sandwort (38%), yellow salsify (12%), and annual bromes (10%). Other prominent forbs were yarrow (10%), silky lupine (5%), and American vetch (8%). Goatweed was absent.

June 1996 – Ten years after the fires, common snowberry again dominated over rose (31% to 13%). Annuals were still a large component. Thymeleaf sandwort declined dramatically to 1%; yellow salsify dropped out, cleavers increased to 12%, and chervil cover increased to 10%. Annual bromes remained constant at 11%. Silky lupine increased to 12%; arrowleaf balsamroot was prominent at 7%, and goatweed had returned to pre-burn levels (9%).

Mountain big sagebrush/Idaho fescue plant association (ARTRV/FEID)

Three plots established prior to the Dooley Mountain burn of 1989 and the Jordan Springs burn of 1994 were used to study the fire effects on vegetation of the mountain big sagebrush/Idaho fescue plant association. The Dooley Mountain plots were re-sampled in years one and five following the burn. The Jordan Springs plot was re-sampled the first year after it burned. The plots are located on south and westerly slopes averaging 27% (20 to 30%) at elevations averaging 5977 ft (5830 to 6100 ft). Two sites burned severely and one burned moderately.

Severe burn findings

Mountain big sagebrush is slow to respond to severe burns. It sprouts from the bases of plants when root crowns are not killed. But many plants were killed by the fire. In the absence of repeated fires every 10-15 years it will reoccupy the site. Coverage by sagebrush averaged 45% in pre-burn communities and only 1% in post-burn communities. Another shrub was affected in just the opposite way. Green rabbitbrush increased from 2% in pre-burn communities to 5% in post-burn communities.

Key herbaceous plants in the pre-burn community were Idaho fescue, bluebunch wheatgrass, creamy buckwheat, and lupines (tailcup and spurred lupines). Idaho fescue declined from 33% to 3% following the burn. Bluebunch wheatgrass was constant at 5% cover. Buckwheat declined from 24% to 3% following the intense burn. Increasers with the fire were yarrow, Sandberg's bluegrass, and tumblemustard.

Plants entering the sites as a result of the severe burn were tall annual willowweed, prickly lettuce, wayside gromwell, western needlegrass, yellow salsify, and arrowleaf balsamroot.

Litter was consumed by the fire decreasing from 27% to 4% in year one and then rebounding to 49% in the fifth year. Bare ground increased from the fire (8% to 37%) in year one, then declined to 23% as litter increased. Moss and lichen cover was scant before and after the burns.

Moderate burn findings

Mountain big sagebrush was reduced by the burn with some individuals succumbing while others resprouted from root crowns the following year. By the fifth year mountain big sage had made a 30% recovery toward pre-burn levels of abundance. Green rabbitbrush was not a part of the pre-burn community and was only a minor component of the post-burn community.

The same key herbaceous plants were part of the pre-burn community as in those of the severely burned plots. Idaho fescue, bluebunch wheatgrass, creamy buckwheat, and yarrow all declined as a result of the fire but by the fifth year had rebounded. Of interest was the change in creamy buckwheat cover. It was an opportunist gaining from 9% cover in the pre-burn community to 15% in the fifth year following the burn. Tailcup lupine and prairie junegrass increased with the fire event. Interestingly Sandberg's bluegrass declined from 7% to 1%. Plants entering the site as a result of this moderate burn were narrowleaf pussytoes, narrow-leaved collomia, tall annual willowweed, thread-leaved fleabane, western hawkweed, western needlegrass, and dandelion.

Litter cover declined from 39% to 19% the first year after the burn; then increased to 55% in the fifth year. Bare ground conversely increased from 6% to 21% the first year after the burn; then declined to 17% in the fifth year. Mosses and lichens increased with this moderate burn from 1% to 4%.

Other findings

Unfortunately sagebrush density was not counted prior to any of the burns. On the Jordan Springs burn a count was made the year after the burn at 14 individual sprouts. This is a density of 151 shrubs per acre.

Deer and elk use of post-burn communities in sagebrush/grassland communities is high. Heavy cropping was witnessed on prickly lettuce, large flowered collomia, and tapertip hawksbeard.

Summary

The severe burn provided the opportunity for a greater increase in rabbitbrush than occurred in the moderately burned plot. Sandberg's bluegrass made a greater gain after the severe burn than in the moderate burn. Idaho fescue was more affected by the severe burn than by the moderate burn. In both burns the species diversity was enhanced. The number of species doubled in both burns from pre-burn to first year after the fire.

Mountain big sagebrush/Idaho fescue plant association (ARTRV/FEID) (n=3)

Burn Intensity	-----Severe----- (n=2)		-----Moderate---- (n=1)		
Species	**PRE**	**1**	**PRE**	**1**	**5**
Shrubs					
mountain big sagebrush (ARTRV)	*45 (65-25)	1 (0-1)	9	1	3
green rabbitbrush (CHVI)	2 (1-3)	5 (0-10)	0	0	1
Grasses					
Idaho fescue (FEID)	33 (26-40)	3 (1-5)	30	7	15
bluebunch wheatgrass (AGSP)	5 (3-7)	5 (5-5)	13	5	10
Sandberg's bluegrass (POSA3)	4 (3-5)	6 (1-10)	7	4	1
mountain brome (BRCA)	3 (1-6)	3 (0-5)	0	5	4
prairie junegrass (KOCR)	0	0	1	4	4
western needlegrass (STOC)	0	2 (0-3)	0	1	1
Perennial Forbs					
creamy buckwheat (ERHE)	24 (18-30)	3 (1-5)	9	5	15
lupines (LUCA, LULA2)	12 (9-15)	8 (6-10)	3	10	6
yarrow (ACMIL)	2 (1-3)	4 (3-5)	7	1	3
wayside gromwell (LIRU)	0	1 (1-1)	0	0	0
arrowleaf balsamroot (BASA)	0	1 (0-1)	0	0	0
narrowleaf pussytoes (ANST)	0	1 (0-1)	0	2	6
western hawkweed (HIAL2)	0	1 (0-1)	0	3	6
threadleaved fleabane (ERFI)	0	1 (0-1)	0	2	4
Annual Forbs					
tumblemustard (SIAL)	1 (1-1)	2 (1-3)	1	0	0
tall annual willowweed (EPPA)	0	1 (0-1)	0	1	1
prickly lettuce (LASE)	0	1 (1-1)	0	0	0
yellow salsify (TRDU)	0	0	0	1	0
narrow-leaved collomia (COLI2)	0	1 (0-2)	0	2	5
Litter	27 (15-38)	4 (1-8)	39	19	55
Bare Ground	8 (6-10)	37 (20-55)	6	21	17
Moss	0	1 (0-1)	1	2	3
Lichen	1 (0-1)	0	0	0	1

* Average Cover (%)

ARTRV/FEID

Plot 8057 **Established - June 1994** **Burned severely - August 1994** **Jordan Springs Fire**
Ralph's Spring, Burns Ranger District, Malheur National Forest

June 1994 – Mountain big sagebrush dominated the site (65%). Gray rabbitbrush was a component at 3%. The most common herbaceous plants were grasses (Idaho fescue dominated at 40%; Sandberg's bluegrass 5%; bluebunch wheatgrass 3%). Creamy buckwheat was prominent at 30% cover.

September 1994 – The fire burned severely owing to the density and volatility of the sagebrush. Woody stems were burned to ground level. Some fescue bunches were killed.

July 1995 – The first year after the fire, sagebrush resprouted with leaders to 6-inch heights. Sagebrush post-burn density approximated 140 sprouts per acre. Gray rabbitbrush tripled to 10%. Grass coverage was less than in the pre-burn community (Idaho fescue and bluebunch wheatgrass = 5%). Sandberg's bluegrass doubled to 10%. Creamy buckwheat declined to 5%.

ARTRV/FEID

Ralph's Spring Plot Location.

June 1994 – Prior to the Jordan Springs Fire.

September 1994 – After the August burn.

July 1995 – First growing season after the fire.

Smooth sumac/bluebunch wheatgrass plant association (RHGL/AGSP)

One plot was used to study effects of fire in the smooth sumac/bluebunch wheatgrass plant association. The plot was established prior to the Joseph-Starvation burn on 1986 in Joseph Canyon. The fire burned moderately across the southeast facing slope. The plot is located at 2750 ft elevation on a 65% slope. It was sampled the first and fifth years following the burn.

Moderate burn findings

The sumac was unaffected by the fire and maintained its 15% cover from pre-burn through post-burn sampling periods. Creeping Oregon-grape and rose were the only other shrubs present in the community; and they maintained their presence. Rose increased slightly after 5 years.

Bluebunch wheatgrass was the most dominant herbaceous plant. It decreased slightly the first year after the burn but increased by the fifth year. Cheatgrass and rattlesnake brome increased as a result of the burn. Tall annual willowweed entered the site in the fifth year. Arrowleaf balsamroot and yellow salsify both entered the community following the burn. Unaffected by the burn were yarrow and lupines.

Litter increased, bare ground declined, and mosses and lichens increased to 3% cover over the 5 years following the fire.

Other findings

Smooth sumac responded vigorously to this moderate burn sending up shoots 12 to 18 inches tall the first growing season after the burn. By the fifth year the sumac shrubs were from 2 to 4 feet tall. It is this kind of burn event that appears to stimulate the included vegetation without appreciable modification of the plant composition. There were no significant declines nor increases in the cover by this moderate burn in this plant association.

Smooth sumac/bluebunch wheatgrass plant association (RHGL/AGSP) (n=1)

Burn Intensity	-----Moderate----- (n=1)		
Species	**PRE**	**1**	**5**
Shrubs			
smooth sumac (RHGL)	*14	15	15
creeping Oregon-grape (BERE)	1	1	1
rose (ROSA)	1	1	3
Grasses			
bluebunch wheatgrass (AGSP)	15	14	21
annual bromes (BROMU)	4	0	7
Perennial Forbs			
yarrow (ACMIL)	1	1	2
lupines (LUPIN)	1	1	1
arrowleaf balsamroot (BASA)	0	1	1
Annual Forbs			
tall annual willowweed (EPPA)	0	0	4
yellow salsify (TRDU)	0	1	1
Litter	32	No	44
Bare Ground	15	Data	4
Moss	0		1
Lichen	0		2

* Average Cover (%)

RHGL/AGSP

Plot 622 **Established - 1981** **Burned moderately - 1986** **Joseph-Starvation Fire**
Joseph Creek Canyon, Wallowa Valley Ranger District, Wallowa-Whitman National Forest

June 1981 – Bluebunch wheatgrass and smooth sumac co-dominated the pre-burn community. Annual bromes were present at 4%.

October 1986 – The moderate burn consumed all standing herbaceous vegetation but left the stems of sumac charred and standing. Sumac leaves were partially consumed.

July 1992 – Five years after the fire sumac remained constant at 15%. Bluebunch wheatgrass increased to 21% to be the dominant plant on the site - eclipsing pre-burn coverages. Annual bromes also increased to 7% coverage.

Ponderosa pine/common snowberry plant association (PIPO/SYAL)

Three plots were installed after the Gould Gulch and Fire Ridge Fires of 1986. Two sites were lightly underburned and one site had received a stand-replacement burn (severe). All plots were established after the fires and sampled in years one and five following the fires.

Elevations of these plots ranged from 3920 ft to 4120 ft (avg. = 4013 ft). Plots are located on northeast and westerly aspects and on slopes ranging from 10% to 50% (avg. = 32%).

Severe burn findings

The majority of the pines (6-10 inches in diameter in a pole-size stand) were killed by crown fire.

The dominant shrubs after 5 years were common snowberry (7% cover) and birchleaf spiraea.

The severe burn on the warm, dry site resulted in a slow response by herbaceous perennials. Dominating in the fifth year were cheatgrass (35%), tall annual willowweed (5%), and moss (48%). Late seral stage plants were scant (pinegrass; prairie junegrass; Idaho fescue). Lupine remained constant at low coverages in both sampling periods. Litter had increased and bare ground had declined between the first and fifth years after the burn. The moss cover of year five essentially covered the bare ground residual from year one after the burn. This attests to the severity of the fire and the inability of perennial plants to occupy the new surface.

Light burn findings

The majority of the trees survived the underburn. By the fifth year seedlings of ponderosa pine covered the ground in patches where the litter and duff were consumed resulting in suitable conditions for pine germination.

Common snowberry had increased over the five years from the light burn event. The only other shrubs present were birchleaf spiraea and creeping Oregon-grape.

Pinegrass increased from 6% to 11% from the first to fifth year after the burns. Plants entering the sites in the fifth year were prairie junegrass, western fescue, prickly lettuce, and tall annual willowweed. Annual bromes (cheatgrass, soft chess, and rattlesnake brome) increased over the 5-year period following the burns. Lupine increased slightly from the first to fifth years.

Litter increased; bare ground decreased; and moss cover averaged 6% five years after the burn.

Summary

This is a dry, warm microenvironment. When disturbances remove perennial plant cover the resulting bare ground heats and becomes desiccated. Thus perennial plants are slow to recolonize.

Common snowberry resprouts readily after light burns. Pinegrass readily flowers and disseminates seed to capitalize on the bareground prepared by the burn. Annual bromes flourished (35% cover) on the severe burn but were much less aggressive on the light burn. Mosses increased dramatically on the severely burned ground surface (48%) compared to the lightly burned surface (6%) owing to the consumption of the litter layer by the fire.

Prickly lettuce was heavily browsed the first year after the burn and was attributed to elk grazing. Snowberry plants also had been browsed.

Ponderosa pine/common snowberry plant association (PIPO/SYAL) (n=3)

Burn Intensity	----Severe---- (n=1)		-----Light---- (n=2)	
Species	**1**	**5**	**1**	**5**
Trees				
ponderosa pine (PIPO)	0	0	0	*1 ◆(1-1)
Shrubs				
common snowberry (SYAL)	1	7	1 (1-2)	5 (5-6)
birchleaf spiraea (SPBE)	0	1	1 (0-1)	1 (0-1)
creeping Oregon-grape (BERE)	0	0	1 (1-1)	1 (0-1)
Grasses				
pinegrass (CARU)	0	1	6 (1-11)	11 (1-20)
Idaho fescue (FEID)	0	1	1 (0-2)	2 (0-4)
western fescue (FEOC)	0	0	0	1 (0-1)
annual bromes (BROMU)	0	35	1 (1-1)	6 (2-10)
prairie junegrass (KOCR)	2	2	0	2 (1-3)
Perennial Forbs				
lupine (LUPIN)	1	1	1 (0-2)	2 (1-3)
Annual Forbs				
tall annual willowweed (EPPA)	0	5	0	2 (1-2)
prickly lettuce (LASE)	0	1	0	1 (1-1)
Litter	34	69	46 (46-46)	79 (64-94)
Bare Ground	54	5	29 (29-29)	5 (2-7)
Moss	1	48	0	6 (6-7)
Lichen	0	1	0	1 (0-2)

* Average Cover (%)
◆ Range of Cover (%)

PIPO/SYAL

Plot 2403 Established - October 1986 Burned lightly - August 1986 Gould Gulch Burn
Fire Ridge, Wallowa Valley Ranger District, Wallowa-Whitman National Forest

August 1986 – A light underburn consumed the standing herbaceous vegetation. Woody stems of shrubs remained standing.

June 1987 – Pinegrass responded rapidly by sprouting and flowering. It dominated with a cover of 11%. Common snowberry resprouted and had a cover of 2%.

July 1992 – Five years after the fire, pinegrass increased its domination by doubling to a cover of 20%. Common snowberry also increased to 6%. Ponderosa pine seedlings were prevalent in high numbers. Lupine was the only forb of note with 3% cover.

Ponderosa pine/pinegrass plant association (PIPO/CARU)

Three plots were used to sample after 1986 burns (Fire Ridge, Blue Canyon, and Scalp). Two plots were established on severely burned sites; one plot was established on a light underburn. The Fire Ridge and Blue Canyon plots were sampled in years one and five following the fires. The Scalp plot was sampled in years one and eight. Elevations ranged from 3790 ft to 5040 ft (avg. = 4560 ft). Plots were oriented on southerly and easterly slopes (5% to 35%) with an average of 20%. Plots were sampled the first and fifth years after the burns.

Severe burn findings

All trees were killed by the severe burns. For this plant association, regular fire periodicity would have resulted in light-intensity underburns.

Snowbrush ceanothus was the only shrub of record on these grass-dominated plots. It increased slightly from year one to year five.

The severity of the burn on these warm, dry sites resulted in slow recolonization by pinegrass. After 5 years it only averaged 3% on these harshly burned plots. Dominating after five years were cheatgrass, hairy chess, and tall annual willowweed. Other herbaceous plants occupying the sites after five years were yarrow, prickly lettuce, and lupine.

Attesting to the severity of the burn and the inability of perennials to colonize was the relatively high percentage of bare ground remaining by the fifth year (29% avg.). Litter had increased from an average of 12% to 41% by year five. The sites were too desiccated to carry mosses to any appreciable amount.

Light burn findings

The underburn resulted in patchy mortality of trees on the site.

No shrubs were found on the plot the first year after the burn. By year five only a trace of common snowberry was found.

Pinegrass clearly dominated in the first and fifth years achieving a cover of 25%. Idaho fescue declined to 1% by year five as the aggressive pinegrass capitalized on the underburn with its flowering and seeding. Yarrow increased slightly and prickly lettuce maintained its occupancy on the site throughout the 5 years. Plants entering the plot by the fifth year were tall annual willowweed, western hawkweed, and lupine.

Litter increased; bare ground decreased dramatically; and mosses tripled over the five years.

Other findings

Orchardgrass seeded on one of the severely burned areas had increased from 1% the year after the burn to 10% by year five. This exotic grass outstripped any other plant on the site for dominance. Only the annual fireweed (*Epilobium paniculatum*) was close in coverage to the orchardgrass at 7%.

On the Scalp Burn plot, ponderosa pine and Douglas-fir were planted the year after the burn. Eight years later only the pines remained. The site with its south aspect and dry, warm microenvironment could not sustain Douglas-fir. The pines were 6 ft tall and vigorous at 248 trees per acre.

Summary

The severe burn provided bare mineral soil (40% cover) for colonization by snowbrush ceanothus, annual bromes, yarrow, and tall annual willowweed. The light burn did not offer the sites required for aggressive occupation by these plants. The only big increase on the light burn was by pinegrass. It more than doubled as a result of the "maintenance" burn.

Ponderosa pine/pinegrass plant association (PIPO/CARU) (n=3)

Burn intensity	-----Severe----- (n=2)		-----Light--- (n=1)	
Species	**1**	**5**	**1**	**5**
Trees				
ponderosa pine (PIPO)	**0**	**0**	**0**	**0**
Shrubs				
common snowberry (SYAL)	**0**	**0**	**0**	*1
snowbrush ceanothus (CEVE)	**1** ◆(0-3)	**2** (1-3)	**0**	**0**
Grasses				
pinegrass (CARU)	**2** (0-5)	**3** (1-5)	**12**	**25**
annual bromes (BROMU)	**0**	**9** (2-16)	**1**	**1**
Idaho fescue (FEID)	**0**	**0**	**4**	**1**
prairie junegrass (KOCR)	**0**	**0**	**0**	**1**
Perennial Forbs				
western yarrow (ACMIL)	**0**	**4** (3-5)	**2**	**3**
lupine (LUPIN)	**0**	**1** (1-1)	**0**	**4**
hawkweeds (HIERA)	**0**	**0**	**0**	**1**
Annual Forbs				
tall annual willowweed (EPPA)	**0**	**8** (7-10)	**0**	**1**
prickly lettuce (LASE)	**1** (0-1)	**1** (0-2)	**1**	**1**
Litter	**12** (5-29)	**41** (30-52)	**75**	**93**
Bare Ground	**40** (40-40)	**29** (17-40)	**18**	**1**
Moss	**0**	**1** (0-1)	**4**	**13**

* Average Cover (%)
◆ Range of Cover (%)

PIPO/CARU

Plot 5703 **Established - October 1986 Burned lightly - August 1986 Fire Ridge Burn**
Fire Ridge, Wallowa Valley Ranger District, Wallowa-Whitman National Forest

October 1986 – Fire burned lightly with virtually no tree mortality.

June 1992 – Five years after the burn, pinegrass clearly dominated (cover = 25%). Other principal herbaceous components were lupine, hawkweed, and yarrow.

Douglas-fir/ninebark plant association (PSME/PHMA)

Six plots located on Douglas-fir/ninebark sites were used to study fire's effects on the vegetation. All plots had been established prior to the fires and were resampled in the first and fifth years after the burns. The plots are located on the Joseph-Starvation and Kuhn Ridge Burns of 1986 and the Teepee Butte Burn of 1988. Four plots were severely burned; two plots were moderately burned. Elevations ranged from 2490 ft to 4950 ft (avg. = 4126 ft). The plots were all on northerly aspects with slopes ranging from 35% to 90% (avg. = 64%).

Severely burned findings

All trees of the overstory and understory were killed by the fire. Ponderosa pine and Douglas-fir composed the pre-burn tree stands. The majority of the pines were dominants and codominants (5%) while the Douglas-fir cover averaged 8% (dominant and co-dominant trees) and 19% (intermediate and suppressed trees). Douglas-fir trees averaged 3% cover in pole-sized trees and 3% in seedlings and saplings.

Shrubs were dominated by ninebark in the pre-burn community (avg. = 51%). The ninebark canopies were consumed by the fire down to charred stubs. The shrub was quick to resprout in the first year following the burns and by the fifth year coverage was approaching pre-burn levels. Common shrub associates, spiraea and common snowberry, were each present at 24% cover in the pre-burn stands, had decreased to only 3% after the fire, and by the fifth year had rebounded to 8%. A shrub not present in the pre-burn communities that entered all sites sampled the first year after the burn as a pioneer was redstem ceanothus. It increased to 12% cover five years after the burns!

Pinegrass generally flourished in these communities following the removal of the tree and shrub canopies by the stand-replacing burns. On the other hand, elk sedge declined significantly from the severe burns (12% in pre-burn community; only a trace in fifth-year community). Heartleaf arnica entered the sites after the burn on 3 of 4 plots and increased over the 5-year period. Bigleaf sandwort was present in the pre-burn community and increased following the burns. Plants that pioneered as new to the community after the fires were yarrow, annual bromes (cheatgrass, soft chess and rattlesnake brome), Columbia brome, fireweeds, prickly lettuce, and varileaf phacelia.

Litter made a decline in the first year but rebounded beyond pre-burn levels in the fifth year. Bare ground increased from the burn but fell below pre-burn levels by the fifth year. Mosses averaged 29% in pre-burn stands but diminished to 10% in fifth year sampling. This may have been in part due to increased movement by ungulates through more open forests resulting from the burn.

Moderate burn findings

One of the two plots burned moderately was an early seral stage community that reburned. No trees had been tallied from the pre-burn data on that plot. The other plot contained ponderosa pine (dominants) and Douglas-fir trees (dominants and intermediates) in the overstory prior to the fire. The trees succumbed to the moderate burn.

Ninebark dominated both stands prior to the burns (avg.= 28%). The ninebark responded rapidly after the burns with 7% cover in the first year and 20% cover by year five. Snowberry and spiraea remained constant from pre-burn to fifth year.

Pinegrass averaged 36% prior to the burns and increased by the fifth year to 45% cover. Elk sedge was not a component of either plot. Heartleaf arnica increased from an average of 7% to 15% after the fifth year. Other herbaceous plants present in the pre-burn community that increased following the burns were woods strawberry, cleavers, mitella, and miner's lettuce. Plants pioneering the post-burn site were bigleaf sandwort, cheatgrass, fireweeds, and prickly lettuce.

Litter remained relatively constant through the sampling period while bare ground increased after the fire returning to near pre-burn levels by year five. Mosses declined (18% to 8%). This is no doubt a result of open stand conditions allowing for greater movement by ungulates across the canyon bunchgrass slopes and through the ninebark stringers.

Other findings

The bare ground increase noted from pre-burn levels was documented as a result of elk and deer trailing, which increased owing to the opening of these sites with easier passage to stringer streams and bunchgrass grazing adjacent to the forested stands. One plot evidenced a 20% increase in bare ground attributed to the wild ungulates.

Some of these areas were seeded to exotics. The retention of exotics is a concern to some managers. Winter wheat was present on one site at 50% cover the first year after seeding. By the fifth year it was absent from the community. On the other hand, orchardgrass was tenacious. On one site it increased from 1% to 10% over the 5 years; on another it declined from 46% in the first growing season after seeding to 19% in the fifth year. Annual ryegrass was also used but was absent by the fifth year of sampling.

A plant that was not present in any early, mid, or late seres of Douglas-fir/ninebark communities but prominently emerged as a pioneer in very early seral stages was verbana (*Verbena bracteata*). It was found at coverages up to 15% the first year after the burns but was gone by year five.

A plant that is common in Douglas-fir/ninebark late seral communities is brittle bladder fern (Johnson and Simon 1987). It was present in over half of the 23 plots used to classify the late seral stage of the type at a coverage of 5%. It was uniformly killed by the burns involved with the fire study plots.

Summary

In the severe burn, elk sedge was diminished as a result of the mortality to rhizomes. However the pinegrass resiliency was rapid and dramatic. Its propensity to survive using both resprouting and seeding strategies attests to its tenacious hold in Douglas-fir plant associations. Interestingly large increases also occurred in the severe burn by heartleaf arnica as it rapidly colonized new ground where shrubs had previously dominated.

Douglas-fir/ninebark plant association (PSME/PHMA) (n=6)

Burn Intensity	-----Severe----- (n=4)			-------Moderate------- (n=2)		
Species	***PRE**	**1**	**5**	**PRE**	**1**	**5**
Trees						
Douglas-fir (PSME)	✱28 ◆(6-45)	0	0	22 (0-45)	0	0
ponderosa pine (PIPO)	8 (0-25)	0	0	10 (0-20)	0	0
Shrubs						
ninebark (PHMA)	51 (22-80)	12 (0-25)	42 (6-60)	28 (21-35)	7 (4-10)	20 (15-25)
birchleaf spiraea (SPBE)	24 (3-9)	3 (0-15)	8 (1-35)	2 (0-4)	2 (0-4)	2 (0-5)
common snowberry (SYAL)	24 (0-50)	3 (1-7)	8 (0-20)	3 (1-5)	1 (1-1)	3 (0-6)
redstem ceanothus (CESA)	0	2 (1-5)	12 (0-35)	0	0	0
Grasses/Sedges						
pinegrass (CARU)	10 (0-20)	5 (0-20)	22 (2-50)	36 (11-60)	19 (3-35)	45 (9-80)
elk sedge (CAGE)	12 (1-20)	1 (0-1)	t (0-1)	0	0	0
annual bromes (BROMU)	0	1 (0-2)	t (0-1)	0	0	1 (1-1)
Columbia brome (BRVU)	0	4 (0-15)	t (0-1)	0	0	0
Perennial Forbs						
heartleaf arnica (ARCO)	5 (0-20)	2 (0-3)	21 (3-55)	7 (3-10)	3 (0-5)	15 (5-25)
western yarrow (ACMIL)	0	t (0-1)	2 (1-3)	3 (0-5)	3 (1-5)	3 (1-5)
varileaf phacelia (PHHE)	0	2 (1-5)	1 (0-1)	0	0	0
woods strawberry (FRVE)	6 (0-20)	0	0	1 (0-2)	7 (0-15)	20 (0-40)
mitella (MIST2)	4 (1-6)	t (0-1)	7 (0-10)	3 (2-3)	3 (0-5)	15 (0-30)
Annual Forbs						
bigleaf sandwort (ARMA3)	2 (1-3)	5 (1-10)	1 (0-3)	0	1 (1-1)	1 (0-1)
prickly lettuce (LASE)	0	6 (3-10)	t (0-1)	0	1 (1-1)	1 (0-1)
cleavers (GAAP)	1 (0-1)	0	2 (0-5)	1 (0-1)	1 (0-1)	8 (1-15)
miner's lettuce (MOPE)	1 (0-5)	1 (0-4)	0	1 (0-1)	1 (0-1)	2 (1-3)
fireweeds (EPILO)	0	1 (0-2)	6 (3-10)	0	2 (0-3)	2 (1-3)
Litter	60 (40-95)	40 (1-82)	78 (75-80)	62 (49-75)	64 (47-80)	57 (44-70)
Bare Ground	18 (0-50)	24 (7-45)	8 (5-10)	7 (5-8)	23 (15-30)	10 (10-10)
Moss	29 (3-55)	15 (0-40)	10 (5-20)	18 (10-25)	4 (0-9)	8 (0-17)

* - 1 plot was established after the burn.
✱ Average Cover (%)
◆ Range of Cover (%)

PSME/PHMA

Plot 176 **Established - 1978** **Burned severely - 1988** **Teepee Butte Burn**
Bear Ridge, Hells Canyon NRA, Wallowa-Whitman National Forest

August 1978 – Douglas-fir trees dominated the overstory with 40% canopy closure. No trees occurred in the forest understory. The shrub layer was dominated by ninebark (22%) and birchleaf spiraea (9%). The herbaceous composition contained pinegrass (4%), elk sedge (5%), and mitella (6%).

September 1988 – A stand-replacing fire killed all the trees and consumed all vegetation on the site. Small logs and other down woody materials were consumed.

September 1989 – The first year after the fire, ninebark and spiraea responded quickly and vigorously providing a cover of 20% and 15% respectively. Seed of red osier dogwood germinated and covered 5% of the site. Herbaceous plants of note were prickly lettuce (10%), varileaf phacelia (5%), and bigleaf sandwort (5%).

Douglas-fir/birchleaf spiraea plant association (PSME/SPBE)

Four plots were used to study fire effects in the Douglas-fir/birchleaf spiraea plant association. Plots were located in three 1986 burns (Dark Canyon, Huckleberry and Crane Creek) and the Canal Burn of 1989. The Canal Burn plot pre-existed and was resampled in the first and fifth years after the fire. The Huckleberry plot was established and sampled for the first time the year after the fire and again five years later. The Dark Canyon and Ryder Creek plots were established and read the first year after the burns. Two plots were located on severe burns; two plots were located on light burns. Elevations ranged from 4560 ft to 5520 ft (avg.= 4898 ft). Plots were located on slopes from 20-50% (avg.= 40%) and north, east and south aspects.

Severe burn findings

All trees were killed by the intense fire.

Birchleaf spiraea cover increased slightly from first to fifth year following the burns. Snowbrush ceanothus was recorded only in the fifth year (10% cover) on the Huckleberry plot.

Pinegrass, elk sedge, and heartleaf arnica were the primary species present the year after the fire. Prickly lettuce and spreading groundsmoke occurred as pioneers the first year following the burn on areas devoid of rhizomatous plants. Plants entering the fifth year at the Huckleberry plot were yarrow, tall annual willowweed, cheatgrass, and soft chess.

Light burn findings

No trees were killed by the underburn. Ponderosa pine and Douglas-fir both survived well from the pre-burn community dominated by pine (cover = 25% dominant/codominant trees; 15% intermediate and suppressed trees; 5% poles; 1% saplings). Douglas-fir accounted for 5% cover in the intermediate category.

Creeping Oregon-grape made a slight increase in year five while spiraea remained constant throughout the post-fire sampling period.

Pioneering the first year after the fire was dogbane. Herbaceous species remaining constant throughout were tailcup lupine and elk sedge. Making increases in the fifth year were yarrow, heartleaf arnica, showy aster, Idaho fescue, and pinegrass. These were stimulated by the light disturbance.

Litter increased, bare ground decreased, and moss cover increased over the five-year sample period.

Other findings

The light burn on Echo Ridge in Big Sheep Canyon killed the bitterbrush plants that were incidental on this site. No regenerating bitterbrush were observed in years one or five.

Summary

The light burn was especially beneficial in the following ways:

- stimulated pinegrass
- did not allow annual bromes to enter the community
- provided higher coverages by perennial forbs
- increased the biological diversity and vitality of included plant species
- provided higher moss cover (15%)

Douglas-fir/birchleaf spiraea plant association (PSME/SPBE) (n=3)

Burn Intensity	---Severe--- * (n=2)		------Light------ (n=1)		
Species	**1**	**5**	**PRE**	**1**	**5**
Trees					
Douglas-fir (PSME)	0	0	*5	5	5
ponderosa pine (PIPO)	0	0	40	35	40
Shrubs					
birchleaf spiraea (SPBE)	6 ◆(3-10)	8	10	10	10
snowbrush ceanothus (CEVE)	0	10	0	0	0
creeping Oregon-grape (BERE)	0	1	3	1	5
Grasses/Sedges					
pinegrass (CARU)	4 (3-5)	10	35	18	70
elk sedge (CAGE)	1 (1-1)	1	3	5	3
annual bromes (BROMU)	0	7	0	0	0
Idaho fescue (FEID)	0	0	3	0	10
Perennial Forbs					
heartleaf arnica (ARCO)	1 (1-1)	0	10	1	5
western yarrow (ACMIL)	0	3	5	4	10
tailcup lupine (LUCA)	1 (0-1)	1	20	10	10
showy aster (ASCO)	0	1	1	1	5
arrowleaf balsamroot (BASA)	0	0	5	1	30
Annual Forbs					
prickly lettuce (LASE)	0	1	0	0	0
tall annual willowweed (EPPA)	0	3	0	0	0
Litter	24 (20-27)	81	80	35	70
Bare Ground	62 (44-79)	12	0	20	10
Moss	0	1	5	0	15

* Both plots established after the fire. Data for year 5 comes from 1 plot only.
* Average Cover (%)
◆ Range of Cover (%)

PSME/SPBE

Plot 807 **Established - 1983** **Burned lightly - 1989** **Canal Fire**
Echo - Big Sheep Ridge, Wallowa Valley Ranger District, Wallowa-Whitman National Forest

August 1983 – Ponderosa pine dominated the overstory (40%). Douglas-fir was present in the overstory (5%) and in the understory (5%). The understory was dominated by pinegrass (35%) with spiraea a component at 10%. Other herbaceous plants of note were heartleaf arnica (10%), tailcup lupine (20%), arrowleaf balsamroot (5%), and yarrow (5%).

August 1989 – No trees were killed by the light underburn. Portions of the herbaceous/shrub understory were underburned.

PSME/SPBE

August 1990 - The fire caused minor changes to the composition the first year after the fire. Spiraea, elk sedge, and yarrow remained unaffected. Pinegrass flowered and resprouted vigorously.

July 1995 - The most notable change was in pinegrass cover. It doubled from pre-burn coverage and increased from 30% to 70% between years 1 and 5 following the burn. Spiraea remained constant at 10%. Herbaceous vegetation changes of note were a six-fold increase in balsamroot (30%), doubling of yarrow to 10%, and increases by showy aster and Idaho fescue.

Douglas-fir/common snowberry plant association (PSME/SYAL)

Three plots were sampled for fire effects in year one and five following burns on sites pertaining to this plant association. The fires were Eagle and Huckleberry in 1986. Each plot was installed after the fires and resampled the first and fifth years after the burn. The three sites burned severely. Elevations ranged from 4350 ft to 4580 ft (avg. = 4557 ft). The three plots occur on north, south, and west aspects. Slopes averaged 35%.

Severe burn findings

All trees were killed by the severe burn.

Shrubs were dominated by spiraea, common snowberry, and snowbrush ceanothus after the burns. Ceanothus averaged 11% cover; spiraea and snowberry were reduced by the fires but remained constant over the post-burn sampling period.

Pinegrass, Idaho fescue, and heartleaf arnica remained constant at low coverage levels. Western fescue increased from the first to the fifth year in cover. Tailcup lupine decreased after the first year. Entering the sites by the fifth year following the burns was soft chess, yarrow, bull thistle, tall annual willowweed and prickly lettuce.

From the first to fifth years after the burns litter increased (21% to 66%), bareground decreased (59% to 16%), and moss entered in the fifth year at 4%.

Summary

These three sites experienced stand-replacement burns. Douglas-fir/snowberry communities historically underburned (Johnson and Simon 1987). The low coverages after five years of snowberry, pinegrass, and western fescue attest to the severity of the burn on this vegetation and its slowness to rebound.

Annual rye had been seeded on the intensely burned sites but had essentially left the scene by the fifth year of sampling. Orchardgrass had increased to 6% cover on two of three intensely burned sites by the fifth year.

Douglas-fir/common snowberry plant association (PSME/SYAL) (n=3)

Burn Intensity	-----Severe----- (n=3)	
Species	**1**	**5**
Shrubs		
common snowberry (SYAL)	*2	2
	◆(1-4)	(1-4)
birchleaf spiraea (SPBE)	1	2
	(0-1)	(1-3)
snowbrush ceanothus (CEVE)	1	11
	(0-2)	(1-17)
Grasses		
pinegrass (CARU)	2	2
	(1-3)	(1-2)
Idaho fescue (FEID)	1	1
	(0-3)	(0-1)
western fescue (FEOC)	t	4
	(0-1)	(0-8)
annual bromes (BROMU)	0	7
		(1-14)
Ross' sedge (CARO)	t	1
	(0-1)	(1-1)
Perennial Forbs		
heartleaf arnica (ARCO)	1	t
	(0-2)	(0-1)
tailcup lupine (LUCA)	5	1
	(0-15)	(0-1)
yarrow (ACMIL)	0	1
		(1-1)
bull thistle (CIVU)	0	3
		(0-5)
Annual Forbs		
tall annual willowweed (EPPA)	0	2
		(1-3)
prickly lettuce (LASE)	0	1
		(1-1)
Litter	21	66
	(4-52)	(55-78)
Bare Ground	59	16
	(38-84)	(11-20)
Moss	0	4
		(0-10)

* Average Cover (%)
◆ Range of Cover (%)

Douglas-fir/mountain snowberry plant association (PSME/SYOR)

One plot pertaining to this plant association burned lightly in the Teepee Butte Burn of 1988. The plot is located at 5200 ft on a 5% slope with an easterly aspect. The plot pre-existed the fire and was resampled the first and fifth years following the burn.

Light burn findings

Douglas-fir and ponderosa pine were retained by the light underburn.

Mountain snowberry declined after the fire but by the fifth year had increased above pre-burn coverages to 20%. Constant throughout pre-burn and post-burn sampling periods was baldhip rose.

Interestingly species known to increase with disturbance showed declines with this light burn! Declining from pre-burn coverages by the fifth-year sampling were yarrow, tailcup lupine, and Kentucky bluegrass. Increasing over the same period were pinegrass, Idaho fescue, and woods strawberry.

Litter increased dramatically (39% to 97%); bare ground declined (12% to 2%) and mosses remained constant at 1%.

Douglas-fir/mountain snowberry plant association (PSME/SYOR) (n=1)

Burn Intensity	-----Light----- (n=1)		
Species	**PRE**	**1**	**5**
Shrubs			
mountain snowberry (SYOR)	*11	7	20
baldhip rose (ROGY)	3	3	4
Grasses			
pinegrass (CARU)	1	1	12
Idaho fescue (FEID)	2	4	8
Kentucky bluegrass (POPR)	35	23	11
annual bromes (BROMU)	3	3	2
Perennial Forbs			
western yarrow (ACMIL)	9	8	3
tailcup lupine (LUCA)	14	24	11
woods strawberry (FRVE)	5	6	12
Litter	39	75	97
Bare Ground	12	13	2
Moss	1	7	1

* Average Cover (%)

PSME/SYOR

Cold Sprints C&T #3 Established - 1957 Burned lightly - 1988 Teepee Butte Fire
Downey Saddle, Hells Canyon NRA, Wallowa-Whitman National Forest

May 1976 – Kentucky bluegrass dominated from past overgrazing by sheep and cattle. Mountain snowberry was the dominant shrub (11%); mountain big sagebrush (4%). Tailcup lupine was the dominant forb (14%).

October 1988 – Douglas-fir and ponderosa pine were underburned with only minor mortality to occasional saplings.

July 1989 – Kentucky bluegrass and tailcup lupine became co-dominant the year after the fires. Mountain snowberry declined in foliar cover but resprouted readily from basal buds. Yarrow and woods strawberry remained constant.

Douglas-fir/pinegrass plant association (PSME/CARU)

This major plant association of the Blue and Wallowa Mountains was represented by seven plots (two in the Wallowas; 5 in the Blues). On six different fires (Joseph-Starvation, Cornet, Sunflower, Huckleberry from 1986; Ryder Creek from 1987; and Canal from 1989). Fire severities were as follows: 3 plots severely burned; 3 plots moderately burned; one plot lightly burned. The Joseph-Starvation and Canal plots pre-existed the fires and were resampled the first and fifth years after the burns. The other plots were established after the fires and were sampled in the first and fifth years following the burns. Plot elevations averaged 5030 ft (4200 to 6400 ft). Aspects represented were north, east, and south. Slopes averaged 35% (10% to 60%).

Severe burn findings

All trees were killed by the stand-replacing fire. The pre-burn stands were dominated by large ponderosa pine (25% cover) and Douglas-fir (10% cover) in the tree overstory. Trees were essentially absent in the tree understory layers (Douglas-fir pole-sized trees = 1%).

Shrubs are weakly present in this plant association, but spiraea, common snowberry, and snowbrush ceanothus did occur in post-burn stands at low coverages (1% or less).

Pinegrass dominates this plant association in all seral stages (avg.= 54% in the Wallowas, 42% in the Blues); Johnson and Simon 1987, Johnson and Clausnitzer 1992. In the first year following the burns, pinegrass declined to 12% coverage; by year five it had increased to 20%.

Decreasing as a result of the intense burn were heartleaf arnica, woods strawberry, and lupines. Species entering the sites as pioneers were yarrow, prickly lettuce, and fireweeds. Tall annual willowweed made dramatic increases on plots in the fifth year.

Litter cover increased the first year after the fire, bare ground increased tenfold (9% in year 5), and mosses decreased sharply (30% to 4%). Liverworts were present the first year after the burns.

Moderate burn findings

In this plant association the moderate burn resulted in overstory ponderosa pine and Douglas-fir trees being retained while some pole- and sapling-sized trees were consumed.

Creeping Oregon-grape exhibited fifth-year increases over first-year coverages.

Pinegrass increased its cover with the moderate burn. Also increasing was yarrow (1% to 15%). Tailcup lupine entered the year after the burn and was dominant with yarrow among forbs in the fifth year.

Litter declined slightly following the burns and bare ground increased. This was attributed to ungulate trailing and their increased usage following the burn. Mosses increased slightly to 5% after the burns.

Light burn findings

The light underburn retained all pine and Douglas-fir overstory trees on the site. After five years, 10 new ponderosa pines had established beneath older trees on areas where mineral soil had been exposed. But for the most part the duff had not been burned by the fire. No Douglas-fir seedlings had yet emerged.

Shrub composition remained minor throughout the sampling periods. Present were common snowberry, creeping Oregon-grape, baldhip rose, birchleaf spiraea, and snowbrush ceanothus.

Pinegrass increased from year one to year five (15% to 40%). As with most responses from burning in this plant association, pinegrass plants set seed and dispersed it to increase its vitality. Also increasing during the same timeframe were yarrow, elk sedge, strawberries, and lupine. Leaving the post-burn community by the fifth year was prickly lettuce, miner's lettuce, bigleaf sandwort, and Alaska oniongrass (*Melica subulata*).

Litter increased and bare ground dramatically declined from first to fifth years following the burn. Moss was a minor component.

Other findings

Fires generally increase species diversity by providing niches for plants not found in later seral stages. The severe burns sampled in Douglas-fir/pinegrass communities provided a doubling of species from the first to fifth years (avg.= 12 in year 1; 24 in year 5). Moderate and light burns resulted in less dramatic shifts by plant species.

Prickly lettuce and miner's lettuce are important constituents of the pioneering first year after severe burns. They not only provided a quick cover but also were found to be used extensively by elk and deer.

Grasses other than pinegrass were good performers. Western fescue provided rank growth (bunches up to 5 inches high) as it flourished in the fifth-year samples. Seeded exotic species could not compete well with pinegrass. Orchardgrass maintained a 4% cover on one plot and was relict on another after five years.

Summary

Moderate and light burns were best for pinegrass enhancement. On severely burned areas it declined 80% the first year after the fires compared to only a 40% decrease on moderate burns. Western fescue tended to increase on moderate and severe burns. It was absent on light burns. Severe burns were very detrimental to lupines. Moderate burns enhanced their occupancy however. Fireweeds needed a severe or moderate burn in order to take up occupancy on the burned site the year after the fire. Mosses demonstrated the greatest increase on severe burns with a coverage of the bare ground averaging 17% after five years.

Douglas-fir/pinegrass plant association (PSME/CARU) (n=3)

Burn Intensity	Severe * (n=1)			Moderate ▲ (n=1)			Light (n=1)	
Species	**PRE**	**1**	**5**	**PRE**	**1**	**5**	**1**	**5**
Trees								
Douglas-fir (PSME)	*10	0	0	25	25	25	10	10
ponderosa pine (PIPO)	25	0	0	18	18	18	40	40
Shrubs								
birchleaf spiraea (SPBE)	0	0	0	0	0	0	1	1
common snowberry (SYAL)	1	0	1	1	0	0	1	1
snowbrush ceanothus (CEVE)	0	0	0	0	0	0	1	1
baldhip rose (ROGY)	0	0	0	0	0	0	1	1
creeping Oregon-grape (BERE)	0	0	0	1	1	5	0	1
Grasses/Sedges								
pinegrass (CARU)	30	12	20	35	30	85	15	40
western fescue (FEOC)	1	0	0	0	1	0	0	0
elk sedge (CAGE)	5	0	0	1	5	0	3	5
Perennial Forbs								
heartleaf arnica (ARCO)	15	9	3	0	0	0	0	0
woods strawberry (FRVE)	5	0	1	1	3	0	1	2
lupines (LUPIN)	50	7	3	0	1	10	0	1
western yarrow (ACMIL)	0	0	3	1	1	15	1	5
western hawkweed (HIAL2)	3	0	1	1	0	1	3	3
bigleaf sandwort (ARMA3)	3	4	3	0	0	0	1	0
Annual Forbs								
prickly lettuce (LASE)	0	10	1	0	1	0	1	0
fireweeds (EPILO)	0	3	15	0	1	15	0	1
Litter	70	81	67	80	65	65	65	95
Bare Ground	1	10	9	1	1	10	20	1
Moss	30	6	4	0	0	5	0	1

* The Joseph-Starvation Burn plot was selected to portray severe burn results.
▲ The Canal Burn plot was selected to portray the moderate burn results.
* Average Cover (%)

PSME/CARU

Plot 891 **Established - 1982** **Burned moderately - 1989** **Canal Fire**

Big Sheep Creek Canyon, Wallowa Valley Ranger District, Wallowa-Whitman National Forest

August 1982 – Douglas-fir veterans of past underburns composed the tree overstory (25% cover). In the tree understory, Douglas-fir saplings (15%) occurred in a herbaceous layer dominated by pinegrass (35%).

August 1989 – The moderate burn underburned with some mortality to intermediate and pole-sized trees. Sapling Douglas-fir trees succumbed. Rocks of the outcropping retained heat allowing the fire to kill associated small dimension trees.

PSME/CARU

August 1990 – Pinegrass returned to near pre-burn coverage (30%) with abundant flowering and seed production. Elk sedge increased to 5%. The only appreciable forb in the post-burn community was woods strawberry (3%).

July 1995 – The fifth year following the burn, pinegrass clearly dominated the community with cover at 85%. Also flourishing were yarrow (15%), pearly everlasting (10%), annual fireweeds (15%), and tailcup lupine (10%). Creeping Oregon-grape had increased from 1% to 5% over the five years since the fire.

Grand Fir/Beadlily Plant Association (ABGR/CLUN)

The Ryder Creek Burn of 1987 burned a forested bottom in Fitzwater Gulch adjacent to the North Fork John Day River. A post-burn plot was installed to follow the response of vegetation. The site burned very intensely killing all trees and leaving only a small unburned "island" where shrubs and herbaceous vegetation were unaffected. The site is in a cold air ponding flat (15% slope) at 3830 ft elevation with a southwest aspect. The plot was resampled the first and fifth years after the burn.

Severe burn findings

All overstory and understory trees (ponderosa pine and western larch) were killed by this burn. Lodgepole pine logs contributed to the fire intensity. Understory trees killed by the fire (grand fir, Douglas-fir, and lodgepole pine) also contributed to fire behavior. By the fifth year following the fire, lodgepole pine and Douglas-fir seedlings covered the plot (486 trees/acre). Lodgepole pine was dominant with 3-foot heights; Douglas-fir was subordinate with ten-inch heights. Lodgepole dominated with a 2:1 ratio. Some grand fir seedlings were beginning to establish.

Shrubs increasing five years after the burn were thimbleberry (1% to 10%), snowbrush ceanothus (3% to 15%), and creeping Oregon-grape (1% to 20%). Shrubs entering the site as a result of the fire were swamp currant, raspberry, common snowberry, blue elderberry, syringa, and Bebb's willow. Twinflower retained its coverage from the post-burn sample based on the unburned "island" population. Soapberry pioneered the site in the first year but was gone by the fifth year.

The fireweed present in the first-year sample was absent in the fifth year. Herbaceous vegetation increasing over the 5-year period were beadlily, Ross' sedge, and northwestern sedge. A predictable fifth-year opportunist coming into the community for the first time was pearly everlasting.

Interestingly liverworts covered 50% of the ground surface the year after the burn. In the fifth year they were gone! Their replacement was by mosses (*Polytrichum juniperum*) which had increased from 5% to 65% through this period.

Other findings

The change from the first year to the fifth year with the vegetation on this site was dramatic. Pioneering plants following the fire had now been replaced in successional order and time. Gone were prickly lettuce, miner's lettuce, bigleaf sandwort, fireweeds, and liverworts. The increase in vegetation was notable not only in species richness (20 in 1988; 30 in 1993) but also in life forms affecting layers and structure. Shrub species numbered six in the first year after the burn. By the fifth year they numbered twelve. The deep soils of this site were not "damaged" by this intense fire. This coupled with the cool, moist microenvironment of the canyon bottom allowed the herbaceous and shrub component of the grand fir/beadlily plant association to rebound vigorously and rapidly.

Grand fir/beadlily plant association (ABGR/CLUN) (n=1)

Burn Intensity	-----Severe-----	
Species	**1**	**5**
Trees		
grand fir (ABGR)	0	0
western larch (LAOC)	*2	5
Douglas-fir (PSME)	5	10
lodgepole pine (PICO)	0	20
Shrubs		
twinflower (LIBO2)	3	3
snowbrush ceanothus (CEVE)	3	15
creeping Oregon-grape (BERE)	1	20
thimbleberry (RUPA)	1	10
swamp currant (RILA)	0	1
common snowberry (SYAL)	0	1
blue elderberry (SARA)	0	1
Bebb's willow (SABE)	0	5
syringa (PHLE2)	0	1
Sedges/Grasses		
pinegrass (CARU)	10	5
sedges (CARO, CACO)	3	6
Perennial Forbs		
beadlily (CLUN)	5	10
pearly everlasting (ANMA)	0	1
fireweeds (EPAN, EPWA)	2	0
Litter	40	35
Bare Ground	1	1
Moss	5	65
Liverworts	50	0

* Average Cover (%)

ABGR/CLUN

Plot 9208 Established - Sept. 1987 Burned severely - August 1987 Ryder Creek Fire
Fitzwater Gulch, North Fork John Day Ranger District, Umatilla National Forest

September 1987 – Fire burned severely, killing all trees and consuming a high percentage of the downed woody material. Note the white ash deposits.

August 1988 – The first year after the fire, liverworts covered 50% of the site and constituted the most dominant plant in the community. Pinegrass responded rapidly with sprouting and flowering (10% cover). Unburned islands populated by twinflower, beadlily, and sedges provided sources of seed for the burned area.

September 1993 – Five years after the burn, liverworts and fireweeds were gone. Shrubs now dominated. Lodgepole pine (20%), Douglas-fir (10%), and western larch (5%) seedlings were abundant. Principal shrubs were snowbrush ceanothus (15%), creeping Oregon-grape (20%), and thimbleberry (10%).

Grand fir/twinflower plant association (ABGR/LIBO2)

A plot located on Summit Ridge west of Buckhorn on Wallowa Valley RD was moderately burned by a small fire in 1986. The plot represented an early seral stage of the grand fir/twinflower plant association. It is on a gentle 10% slope with a northwesterly aspect at 5280 ft elevation. The pre-burn community was dominated by western larch, Douglas-fir, and lodgepole pine. The plot was resampled the first and fifth years after the burn.

Moderate Burn findings

The fire killed all lodgepole pine, Douglas-fir, and grand fir. These species had all been present in pole-sized trees (lodgepole pine, larch) and saplings (Douglas-fir, grand fir). Western larch was partially affected with some trees killed (5% poles); but others survived (10% intermediate size trees). By the fifth year following the burn, lodgepole pine seedlings were dominant across the plot. Western larch, Douglas-fir, and grand fir seedlings were also present.

Principal shrubs that declined were the two pre-burn dominants; twinflower and big huckleberry. By the fifth year both were reasserting their dominance. Utah honeysuckle was severely impaired by the burn. Capitalizing on the fire were two shrubs not present in the pre-burn community: creeping Oregon-grape (which entered the first year after the fire) and Scouler willow (which entered following the first year sample).

Among the herbaceous plants present in the pre-burn community, Columbia brome and woods strawberry were absent in the first year following the fire. They both responded vigorously by the fifth year. Pinegrass and Ross' sedge entered the site for the first time following this moderate burn. Plants that maintained their coverage through the burn were Piper's anemone, fireweeds, and round-leaved violet.

Surface features did not change markedly. Litter cover increased and bare ground declined from pre-burn averages based on coniferous needle fall the first year and an increased herbaceous component the following years. Mosses stayed at about 5% cover throughout the period. Liverworts entered the community in the first year after the burn (4%) but had left by the fifth year.

Summary

This moderate burn did little to change the composition except for lowering coverages by principal species. By the fifth year they began reasserting their prior positions relative to one another within the post-fire community. For example, big huckleberry and twin flower each had declined ten-fold from pre-burn coverages at year five. A slight dominance by huckleberry over the twinflower reflected the slightly warmer and drier post-burn microenvironment favoring huckleberry. Aggressive to the open growing portions of the plot were opportunistic species (e.g., Scouler willow, pinegrass, Ross' sedge, and Columbia brome).

Grand fir/twinflower plant association (ABGR/LIBO2) (n=1)

Burn Intensity	-----Moderate----- (n=1)		
Species	**PRE**	**1**	**5**
Trees			
grand fir (ABGR)	*5	0	3
Douglas-fir (PSME)	20	0	3
western larch (LAOC)	15	5	5
lodgepole pine (PICO)	35	0	15
Shrubs			
twinflower (LIBO2)	70	0	7
big huckleberry (VAME)	65	3	11
Utah honeysuckle (LOUT2)	5	1	0
creeping Oregon-grape (BERE)	0	1	1
Scouler willow (SASC)	0	0	3
Grasses/Sedges			
Columbia brome (BRVU)	5	0	8
pinegrass (CARU)	0	0	3
Ross' sedge (CARO)	0	2	1
Perennial Forbs			
woods strawberry (FRVE)	10	0	4
Piper's anemone (ANPI)	1	1	1
round-leaved violet (VIOR2)	5	1	1
fireweeds (EPAN, EPPA)	1	1	3
Litter	40	86	83
Bare Ground	15	6	9
Moss	5	4	6
Liverworts	0	4	0

* Average Cover (%)

Grand fir/big huckleberry plant association (ABGR/VAME)

Three plots were selected to study fire's effects on the communities of this plant association. One plot was burned lightly by the Twin Lakes Burn of 1994. It is located at 5450 ft elevation on a 30% slope with a southerly aspect. Another Twin Lakes Burn plot, burned severely, is located at 5450 ft elevation on a 30% slope with a northwesterly aspect. The third plot was burned severely on the Deardorff Burn of 1986. It is located at 5780 ft elevation on a 60% slope with a southeasterly aspect.

The findings from the Twin Lakes plots are first-year data. The findings from the Deardorff Burn plot are from first- and eighth-year samples following the burn.

Severe burn findings

All tree species were killed by stand-replacement burns. Grand fir dominated this late seral community before the burn (30% cover by dominant and codominant trees; 25% cover by intermediate and suppressed trees; 15% cover by poles; 10% cover by saplings). The only other principal tree species present was Douglas-fir (10% cover dominant and codominant trees).

Sitka alder was a component on one of the plots prior to the fire. It was killed by the burn. Utah honeysuckle was also killed by the intense burn. Big huckleberry declined dramatically on the severely burned sites. The only shrub to increase with the burn was spiraea (5% to 11%). As a result of the intense burn, snowbrush ceanothus and Scouler willow came onto the site.

One of the plots had a dominant seral stage defined by bracken. The deep-seated rhizomes of this species enabled it to survive and flourish with this burn. Heartleaf arnica declined the first year after the burn. Fireweeds entered the communities after the fire.

Litter cover decreased and bare ground increased the first year after the burn. Cryptogam coverage increased markedly. Liverworts entered the site the first year following the burn. The fast response by cryptogams assisted in thwarting rainsplash, rill, and sheet erosion.

Light burn findings

The underburn reduced the late seral grand fir coverage. The tree overstory was diminished (55% to 40%) and tree understory reduced as well (10% to 5%) the first year following the burn. The underburn was continuous with fire only scorching the basal portion of the large 30-40" diameter trees. A thicket of grand fir saplings only lost 30% of its occupants.

Utah honeysuckle was unaffected by the burn. Scouler willow seed was scarified by the light burn resulting in a dominating layer of shrub seedlings. Snowbrush ceanothus was another shrub found in the post-burn community at low coverage.

Of the pre-burn herbaceous plants, Ross' sedge and woods strawberry decreased with the light burn. Pioneering the burned area were fireweeds, prickly lettuce, thistle, and yellow salsify. Houndstongue was present as a rank weed.

The surface cover changed predictably the first year after the fire. Litter decreased; bare ground increased; moss cover went from a trace to 20%. Liverworts occurred at low coverage.

Summary

Grand fir/big huckleberry forests are often burned with varying intensities. They may be the portion of a larger forest landscape that succumbs to stand-replacing fire fueled by down woody material and maintained by flashy fir crowns. Or they may be at the upper elevations in montane settings where the humidity and downslope winds may combine to lower the fire's intensity allowing it to burn moderately or underburn beneath the firs. Weather patterns and diurnal changes (e.g., humidity and wind) also influence the severity and extent of burning in these plant communities.

The light underburn in a late-seral grand fir/big huckleberry community brought a new shrub/herbaceous component to the site. Scouler willow, fireweeds, and snowbrush ceanothus defined the early seral stage of succession. The species richness increased (15

different species in the pre-burn community; 34 species in the post-burn community).

With stand-replacement burns, Scouler willow, snowbrush ceanothus, and fireweeds dominated the sites with fire mosses and liverworts. Ceanothus and bracken are fierce competitors that can become long-term dominants of the site and retard tree regeneration and other shrub and herbaceous vegetation. Species richness declined on the two severely burned plots to 65% of pre-burn levels (23 species to 15 species).

Grand fir/big huckleberry plant association (ABGR/VAME) (n=2)

Burn Intensity	----Severe---- (n=1)		----Light---- (n=1)	
Species	**PRE**	**1**	**PRE**	**1**
Trees				
grand fir (ABGR)	**75**	**0**	65	45
Shrubs				
Sitka alder (ALSI)	***5**	**0**	0	0
Utah honeysuckle (LOUT2)	**10**	**0**	1	1
big huckleberry (VAME)	**45**	**1**	0	0
birchleaf spiraea (SPBE)	**5**	**11**	0	0
snowbrush ceanothus (CEVE)	**0**	**1**	0	1
Scouler willow (SASC)	**0**	**10**	0	10
Grasses/Sedges				
pinegrass (CARU)	**1**	**1**	0	0
elk sedge (CAGE)	**1**	**0**	0	0
Ross' sedge (CARO)	**0**	**0**	10	3
Perennial Forbs				
bracken (PTAQ)	**-***	**65**	1	0
heartleaf arnica (ARCO)	**5**	**1**	0	0
fireweeds (EPILO)	**0**	**6**	0	1
sidebells pyrola (PYSE)	**10**	**0**	1	0
woods strawberry (FRVE)	**0**	**0**	10	3
Litter	**60**	**1**	95	50
Bare Ground	**1**	**5**	0	30
Moss	**20**	**60**	1	20
Lichen	**5**	**20**	1	1
Liverwort	**0**	**20**	0	1

* Data unavailable for comparison
* Average Cover (%)

ABGR/VAME

Plot 1221 **Established - July 1985** **Burned lightly - August 1994** **Twin Lakes Fire**
Pole Creek, Pine Ranger District, Wallowa-Whitman National Forest

July 1985 - Grand fir dominated the tree overstory (55%) and understory (10%). The most abundant herbaceous plants were Ross' sedge (10%) and woods strawberry (10%). Shrubs were almost absent.

October 1994 - The site was burned lightly. The fire understory coverage by 50% (majority were pole sized).

August 1995 - The most prolific understory plant was Scouler willow (10%) the first year after the burn. Strawberry and sedges were the most abundant herbaceous plants.

Grand fir/birchleaf spiraea plant association (ABGR/SPBE)

Three plots were installed in vegetation representing the grand fir/spiraea plant association following the Deardorff, Huckleberry, and Crane Creek Fires of 1986. The plots occur on east, south, and north aspects at elevations ranging from 4740 ft to 5730 ft (avg. = 5077 ft). Slopes ranged from 30% to 55% (avg.= 43%). The fire burned moderately, leaving some patches of unburned vegetation on one plot, and burned severely on the other two plots. One burn was seeded aerially with the following species subsequently establishing on the plot area: orchardgrass, perennial rye, and clover. Sampling occurred the first year and fifth year after the burns on Huckleberry and Crane Creek plots; the eighth year on the Deardorff Burn plot.

Severe burn findings

The fire killed virtually all trees on the site. By the fifth year ponderosa pine and lodgepole pine were re-entering the site. Lodgepole pine dominated by an 85:15 ratio over ponderosa pine. Lodgepole pines were 4 feet tall after the fifth year.

Scouler willow and snowbrush ceanothus both entered the sites following the burn. By year five ceanothus cover averaged 32% on the two sites. Spiraea remained constant at 7% cover over the post-burn period. Creeping Oregon-grape was present at low cover on both plots.

Herbaceous vegetation made notable increases in the fifth year. Yarrow, pinegrass, western fescue, and woods strawberry all increased. Elk sedge capitalized on the bare ground and dramatically entered the community in the fifth year following the fire.

Litter increased; moss and bare ground declined over the 5-year period. Liverworts and mosses were quick to pioneer in the first year. The bare ground in year five was attributed in large part to disturbance from pocket gophers and elk trailing.

Moderate burn findings

All trees were killed by the burn except where an unburned patch retained Douglas-fir saplings. The pre-burn forest consisted of western larch, Douglas-fir, ponderosa pine, and grand fir trees. In the fifth-year sampling, ponderosa pine and Douglas-fir seedlings dominated the pioneering tree population but western larch and grand fir were also represented.

The first year after the burn, spiraea was the most dominant plant found on the site. By the fifth year it had doubled its coverage to 11% and retained its dominance of the site. Entering the community as a result of the burn were snowbrush ceanothus and Scouler willow. By the fifth year other shrubs occurring were rose, common snowberry, Oregon boxwood, mountain-mahogany, and kinnikinnick.

The herbaceous native plant cover did not appreciably change from the first year to the fifth year with the exception of elk sedge, which increased slightly. Pinegrass dominated the herbaceous vegetation with showy aster, yarrow, and woods strawberry also prominent in the post-burn community.

Litter coverage increased and bare ground decreased over the 5-year period. Mosses were present at 8% cover in the first year after the burn. By the fifth year they had increased their cover five-fold to 43%!

Summary

The severe burn was favorable to the aggressive rhizomatous plants (pinegrass and elk sedge) as well as snowbrush ceanothus. The moderate burn promoted spiraea more than the severe burn and was less favorable to ceanothus, elk sedge, and pinegrass colonization.

The herbaceous exotic seedings showed dramatic change from the two sampling periods. Orchardgrass declined from 34% cover to 7%; perennial rye and clover both left the community by the fifth year.

Grand fir/birchleaf spiraea plant association (ABGR/SPBE) (n=3)

Burn Intensity	----Severe---- (n=2)		----Moderate---- (n=1)	
Species	**1**	**5/8**	**1**	**5**
Trees				
grand fir (ABGR)	0	-*	-	-
lodgepole pine (PICO)	0	*3 ◆(1-5)	-	-
ponderosa pine (PIPO)	t (0-1)	1 (1-1)	-	-
Shrubs				
birchleaf spiraea (SPBE)	8 (5-10)	7 (3-10)	5	11
creeping Oregon-grape (BERE)	3 (3-3)	2 (1-3)	0	0
snowbrush ceanothus (CEVE)	2 (1-3)	32 (10-55)	0	1
Scouler willow (SASC)	0	2 (0-3)	0	1
Grasses/Sedges				
elk sedge (CAGE)	0	13 (5-20)	1	3
pinegrass (CARU)	10 (5-15)	13 (5-20)	4	4
western fescue (FEOC)	1 (0-1)	3 (0-5)	0	1
Perennial Forbs				
western yarrow (ACMIL)	1 (0-1)	5 (1-10)	1	1
woods strawberry (FRVE)	1 (0-1)	2 (0-3)	1	2
showy aster (ASCO)	1 (0-1)	3 (0-5)	2	2
Litter	8 (5-10)	52 (25-80)	57	76
Bare Ground	25 (20-30)	12 (3-20)	10	7
Moss	10 (0-20)	5 (0-10)	8	43

* Data unavailable
* Average Cover (%)
◆ Range of Cover (%)

ABGR/SPBE

Plot 9169 Established - August 1987 Burned severely -August 1986 Crane Creek Fire
North Fork John Day River Canyon, North Fork John Day Ranger District,
Umatilla National Forest

August 1987 – All trees were killed by the fire. The first year after the burn, spiraea dominated (10%) with creeping Oregon-grape (3%) and ceanothus (1%). Herbaceous vegetation was co-dominant by pinegrass and bigleaf sandwort (5% each).

July 1996 – In the 10th year after the burn, lodgepole pine and ponderosa pine seedlings populated the site with lodgepole dominant (4 ft tall) at 5% cover. Ceanothus had increased (10%) to co-dominate with spiraea in the shrub layer. Scouler willow had entered the community at 3%. Prominent herbaceous plants were elk sedge (20%), pinegrass (5%), western fescue (5%), and yarrow (10%).

Grand fir/pinegrass plant association (ABGR/CARU)

A total of seven plots were established following four wildfires that pertain to this plant association. All of the burns were in the Blue Mountains. The distribution of plots is as follows:

Scalp Fire - 1986 2 plots sampled first and fifth years following the burn
Ryder Creek Fire - 1987 2 plots sampled first and fifth years after the burn
Deardorff Fire - 1986 1 plot sampled the first year after the burn
Snowshoe Fire - 1990 2 plots sampled the first year after the burn

The plots ranged in elevation from 4930 ft to 5940 ft (avg. = 5507 ft) with slopes averaging 30% (15% to 50%). Aspects were principally southerly (5 plots) with 1 plot each in northerly aspects and westerly aspects.

Fire intensities of the 7 plots were as follows: severe, 5 plots; moderate, 1 plot; partial, 1 plot.

Severe burn findings

All overstory trees were killed in fires that burned severely. The tree understories were all killed by the burns. In the first year of resampling ponderosa pine (a fire seral tree) began to re-enter the communities. By the fifth year Douglas-fir was also entering the sites again. Grand fir was not yet capable of surviving owing to the modified microenvironment.

The shrub composition is minimal in this plant association in those communities late in succession. However pioneering the sites after the intense burns was a constant performer -- snowbrush ceanothus. After the fifth year it ranged from 1% to 20% (avg.= 12%). The only other shrub of note was creeping Oregon-grape which was found consistently in the first-year samples.

Pinegrass was highly constant throughout first and fifth year samples. It averaged 8% cover in first year samples and 17% in fifth-year samples. Elk sedge was another constant associate with pinegrass. Several herbaceous plants became prominent by the fifth year of sampling on harshly burned sites: yarrow, mountain brome, bull thistle, woods strawberry, and annual bromes (cheatgrass, hairy chess). Fireweeds and prickly lettuce entered the severe-burn sites the year after the burn and remained at low coverage in the fifth year.

Litter increased and bare ground declined between the first and fifth sample years. Cryptogams increased to 7%.

Moderate burn findings

Overstory trees were retained in the moderately burned plot where Douglas-fir and ponderosa pine survived. Understory trees were killed by the fire. By the fifth year, 12 ponderosa pine and 5 Douglas-fir seedlings had established.

Shrub composition was light. Scouler willow and snowbrush ceanothus were both present at only 1% cover.

Pinegrass and elk sedge were quick to respond. Elk sedge made the greatest increase over the five years (3% to 10%). Entering the site in the fifth year were yarrow, mountain brome, bull thistle, western fescue, and woods strawberry. Interestingly, no annual bromes entered this moderately burned site.

Bare ground decreased in cover; litter cover remained relatively constant; and mosses increased over the five-year period.

Partial burn findings

The tree overstory was retained to 55% cover by the sporadic light underburn.

Snowbrush ceanothus was the dominant shrub with a cover of 25%.

Pinegrass cover was the highest of all post-burn grand fir/pinegrass community plots at 55% cover the first year after the burn. Other herbaceous vegetation was scant.

Other Findings

The grand fir/pinegrass plant association represents a classic Blue Mountain example of vegetation composition often referred to as being outside the historic range of variation

owing to lack of periodic underburns. The pine-dominated open understories with pinegrass and elk sedge are often overstocked and compositionally growing a disproportionate number of grand fir as a result. Only the moderate and mosaic-burned plots represent the fire effects usually associated with this plant association. It should not burn intensely if fire were within its normal cycle.

The Scalp Burn was planted to ponderosa pine and Douglas-fir. Interestingly, the plot with a southerly aspect had 28 Douglas-fir in the first sample year but by the fifth year only 9 remained. At the same elevation nearby on another plot, where the aspect was northerly, all planted stock (11 pine, 11 Douglas-fir) remained. The Douglas-fir were 3 ft tall on the southerly site; 4 ft tall on the northerly site.

Pioneering plants provide a protective foliar cover to the site in the first years following the burns. One of these, prickly lettuce, was highly present in the first year samples but dropped out of the community by the fifth year. Others that were constant in the first year samples but gone by the fifth year were cryptantha and miner's lettuce.

Species richness is enhanced by the retrogression to earlier seral stages. In the plots sampled the first year after the burn, the number of plant species averaged ten. In the fifth year the average number of plant species had increased to 21. By the return to late seral stages, grand fir/pinegrass plant communities average approximately 10 shrub and herbaceous species (Johnson and Simon 1987). Biological diversity is improved when early- and mid-seral stage forested stands occur as part of the coniferous forest landscape.

Grand fir/pinegrass plant association (ABGR/CARU) (n=6)

Burn Intensity	-----Severe----- (n=5)		----Moderate---- (n=1)	
Species	**1** (n=5)	**5** (n=3)	**1**	**5**
Trees				
grand fir (ABGR)	**0**	**0**	**0**	**0**
Douglas-fir (PSME)	**0**	***1** ◆(0-3)	**20**	**25**
ponderosa pine (PIPO)	**5** (0-20)	-*	**10**	**13**
Shrubs				
snowbrush ceanothus (CEVE)	**9** (3-30)	**12** (1-20)	**1**	**1**
creeping Oregon-grape (BERE)	**1** (1-2)	**0**	**0**	**0**
Scouler willow (SASC)	**t** (0-1)	**0**	**0**	**1**
Grasses/Sedges				
pinegrass (CARU)	**8** (0-55)	**17** (1-30)	**5**	**5**
elk sedge (CAGE)	**2** (0-3)	**2** (0-5)	**3**	**10**
mountain brome (BRCA)	**0**	**3** (1-15)	**0**	**5**
annual bromes (BROMU)	**0**	**9** (3-26)	**0**	**0**
western fescue (FEOC)	**0**	**0**	**0**	**10**
Perennial Forbs				
western yarrow (ACMIL)	**t** (0-1)	**3** (5-10)	**0**	**3**
bull thistle (CIVU)	**1** (0-3)	**5** (0-15)	**0**	**15**
fireweeds (EPILO)	**1** (0-3)	**1** (1-1)	**0**	**1**
woods strawberry (FRVE)	**0**	**2** (1-4)	**0**	**8**
Annual Forbs				
prickly lettuce (LASE)	**1** (0-3)	**1** (0-1)	**1**	**0**
Litter	**33** (3-77)	**53** (40-80)	**35**	**30**
Bare Ground	**34** (15-30)	**20** (10-40)	**30**	**15**
Moss	**0**	**4** (0-10)	**0**	**10**
Lichen	**t** (0-1)	**3** (0-10)	**0**	**0**

* Data unavailable
* Average Cover (%)
◆ Range of Cover (%)

ABGR/CARU

Plot 9179 **Established - August 1987 Burned severely - August 1986 Scalp Fire**
Van Aspen Ridge, Bear Valley Ranger District, Malheur National Forest

August 1987 – The first year after the burn, bare ground was prevalent. Herbaceous plants of greatest prominence were pinegrass (20%) and heartleaf arnica (10%). Ceanothus had entered the community following the severe burn with a cover of 5%.

July 1995 – Eight years later pinegrass had increased to 30%. Heartleaf arnica had declined to 1% with strawberry (4%) and yarrow (5%) as the newest prominent forbs. Ceanothus had increased to a cover of 20%. Ponderosa pine and Douglas-fir had been planted and were co-dominant on the site at 3% cover each. No grand fir seedlings had yet established.

Grand fir/grouse huckleberry plant association (ABGR/VASC)

The four plots selected to study fire effects in grand fir/grouse huckleberry communities were all in the Blue Mountains. The samples came from two 1986 fires -- Crane Creek and Clear. The plots were all established after the burns. The Crane Creek plots were resampled in the 10th year; the Clear burn plot was resampled in the fifth year. The plots ranged from 4680 ft to 6260 ft in elevation (average = 5070 ft) on east and south aspects with slopes averaging 20% (5% to 40%). Three plots were installed on severe burns and one plot on a moderately burned site.

Severe burn findings

All trees were killed in the overstory and understory by stand-replacing fire. After 10 years lodgepole pine seedlings carpeted the sites covering 50% of the area! Western larch accounted for another 13% coverage and ponderosa pine seedlings entered the sites at 1% cover.

Grouse huckleberry was absent in the first year following the burn but responded well by the tenth year. Other shrubs in the post-burn community were spiraea, Scouler willow, snowbrush ceanothus, Oregon boxwood, soapberry, and creeping Oregon-grape. Especially noticeable was the colonization by ceanothus. It occupied a large portion of the sites with a coverage of 25% after 10 years. Only lodgepole pine seedlings and saplings had greater occupancy of the sites.

Pinegrass was the most prolific and rapid herbaceous plant to respond on the post-burn sites. Replacement of the pinegrass stand in one tenth-year plot sample had been achieved by silky lupine and strawberries (a combined 50% cover). Other herbaceous plants occupying the post-burn sites were fireweed, bull thistle, elk sedge, northwestern sedge, yarrow, and mountain brome. Prickly lettuce pioneered the site immediately after the burn but was absent by the tenth year.

Bare ground decreased, litter increased, mosses doubled, and lichens declined over the 10-year sampling period. Liverworts were pioneers in the first year but were absent by the 10th year.

Moderate burn findings

The trees were killed by a stand-replacement burn except for unburned patches where lodgepole pine seedlings were spared. By the fifth year lodgepole pine seedlings carpeted the ground on the plot.

Grouse huckleberry resprouted in the first year and covered 4% of the plot after the fifth year. Only Scouler willow had a coverage to equal it among the shrubs.

Pinegrass was quick to occupy the burned ground and covered 4% of the area after 5 years. Other herbaceous plants were not encountered until the fifth year sampling. These were woods strawberry, tall annual willowweed, bull thistle, soft chess, and bigleaf sandwort.

The most notable ground cover was demonstrated by mosses, which occupied 2% of the surface after the first year but a hefty 56% by year five!

Summary

Grouse huckleberry is a tenacious survivor of severe burns and readily re-occupies the exposed sites, which are often drier and colder than before the burn. Ceanothus needed the severe burns in order to germinate and establish. It was not found on the moderate burn. Lupines and strawberries (especially woods strawberry) were important early seral components of the severely burned site. Both western larch and lodgepole pine were significant colonizers of the severely burned grand fir/grouse huckleberry communities. A high percentage of bare ground in the tenth-year samples was a attributed to pocket gopher activity.

Grand fir/grouse huckleberry plant association (ABGR/VASC) (n=4)

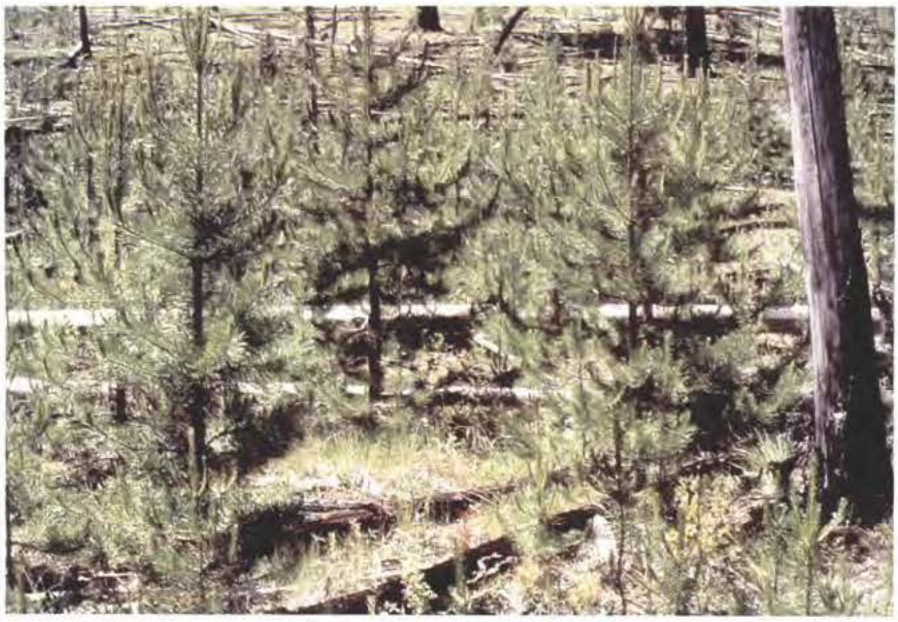
Burn Intensity	-----Severe----- (n=3)		----Moderate--- (n=1)	
Species	**1**	**10**	**1**	**5**
Trees				
grand fir (ABGR)	0	0	0	0
western larch (LAOC)	0	*13 ◆(0-30)	0	0
lodgepole pine (PICO)	0	50 (40-70)	1	25
Shrubs				
grouse huckleberry (VASC)	0	7 (5-10)	1	4
birchleaf spiraea (SPBE)	3 (1-5)	4 (0-10)	0	0
Scouler willow (SASC)	t (0-1)	4 (0-10)	0	4
snowbrush ceanothus (CEVE)	0	25 (0-75)	0	0
Grasses/Sedges				
pinegrass (CARU)	9 (3-20)	7 (1-15)	1	4
elk sedge (CAGE)	0	1 (0-1)	1	1
northwestern sedge (CACO)	0	4 (0-10)	0	1
mountain brome (BRCA)	0	2 (0-5)	0	0
Perennial Forbs				
silky lupine (LUSE)	0	8 (0-20)	0	0
strawberries (FRVE, FRVI)	t (0-1)	17 (0-30)	0	1
western yarrow (ACMIL)	0	2 (0-5)	1	0
bull thistle (CIVU)	t (0-1)	1 (0-1)	0	1
fireweed (EPAN)	2 (1-5)	1 (1-1)	0	1
Annual Forbs				
prickly lettuce (LASE)	t (0-1)	0	0	0
tall annual willowweed (EPPA)	2 (1-5)	1 (1-1)	0	1
Litter	9 (1-20)	17 (5-25)	93	79
Bare Ground	30 (0-65)	22 (10-35)	5	4
Moss	13 (0-20)	27 (5-45)	2	56
Lichen	7 (0-10)	2 (1-5)	1	0

* Average Cover (%)
◆ Range of Cover (%)

ABGR/VASC

Plot 9168 **Established - August 1987 Burned severely - August 1986 Crane Creek Fire North Fork John Day River Canyon, North Fork John Day Ranger District, Umatilla National Forest**

August 1987 – All trees were killed by the severe burn. The first year after the fire very little vegetation occurred on the site. Pinegrass dominated (3%). Scouler willow and spiraea were present as the only shrubs.



July 1996 – The 10th year after the burn lodgepole pine and larch seedlings almost fully occupied this site. Lodgepole pines dominated 2:1 over larch and outgrew them (6 ft tall to 2 ft tall). Grouse huckleberry was now the dominant shrub (5%). Herbaceous vegetation was dominated by strawberries (20%), pinegrass (5%), western fescue (5%), northwestern sedge (10%), and mountain brome (5%).

Subalpine fir/elk sedge plant association (ABLA2/CAGE)

Two plots were established on severely burned sites following the Clear Burn in the Blue Mountains. The vegetation was sampled the first and fifth years following the burn. Elevations were 6860 ft and 7020 ft. Both plots had southerly aspects and were on gentle slopes (15%).

Severe burn findings

All trees were killed by stand replacement fire in the overstory and understory.

Shrubs were essentially absent from the herbaceous-dominated understory.

Elk sedge responded rapidly and had increased to 11% coverage by the fifth year. Other herbaceous plants responding to pioneer the site in the first year were bigleaf sandwort and heartleaf arnica. By the fifth year the following plants had entered the community: yarrow, mountain brome, and tall annual willowweed.

Ground cover shifted from a dominance by bare ground the first year after the burn (avg.= 77%) to an average cover of 23% in the fifth year. Litter was responsible for the decrease in bare ground (avg.= 20% in year 1; 60% in year 5). Mosses were present at 1% in the fifth year after an absence in the first sample year.

Summary

Similar to grand fir/pinegrass communities, these late seral communities are generally overstocked and vulnerable to severe stand-replacement fires as a result of fire exclusion from the system. They would normally have a fire-return interval of about 10-20 years and would burn moderately or lightly as a result. The lack of tree seedlings and low coverages by all other plants attests to the inability of community components to respond after the severe fire.

These sites were seeded with orchardgrass and timothy. In the first year these plants each covered 1% of the area. By the fifth year orchardgrass and timothy had both increased to 4% cover. The aggressive elk sedge mats were probably responsible for limiting the amount of increase by the exotic grasses.

Subalpine fir/elk sedge plant association (ABLA2/CAGE) (n=2)

Burn Intensity	Severe (n=2)	
Species	**1**	**5**
Grasses/Sedges		
elk sedge (CAGE)	*2 ◆(1-2)	11 (5-17)
mountain brome (BRCA)	0	1 (1-1)
Perennial Forbs		
heartleaf arnica (ARCO)	1 (1-1)	0
bigleaf sandwort (ARMA3)	1 (1-1)	2 (1-2)
western yarrow (ACMIL)	0	1 (0-1)
bull thistle (CIVU)	0	1 (0-1)
Annual Forbs		
tall annual willowweed (EPPA)	0	4 (3-5)
Litter	20 (13-26)	60 (56-64)
Bare Ground	77 (63-90)	23 (14-32)
Moss	0	1 (1-1)
Lichen	0	t (0-1)

* Average Cover (%)
◆ Range of Cover (%)

ABLA2/CAGE
Plot 706 **Established - October 1986 Burned severely - August 1986 Clear Fire**
Black Butte, Baker Ranger District, Wallowa-Whitman National Forest

October 1986 – Burned severely with all trees killed.

September 1987 – The first year after the fire bare ground was predominant (90%) on the high elevation, cold-dry sites. Exotic seedings introduced orchardgrass, timothy, cereal rye, and mountain brome. Elk sedge was the most abundant native plant (1%).

August 1992 – Five years later bare ground cover was down to 32%. Timothy and orchardgrass had increased to a total of 6%. However, elk sedge was aggressively colonizing with a cover of 17%. Tall annual willowweed was actively occupying the dry site at 5% cover.

Subalpine fir/fool's huckleberry plant association (ABLA2/MEFE)

This plant association is found primarily in the Seven Devils Mountains of Idaho within the study area. Three Idaho-based plots were burned in 1994 by the Rapid River Fire; the other plot was burned by the Summit Fire in 1989. Two plots burned severely killing all trees. One of these plots was on gentle terrain (10% slope); the other on steep topography (60% slope). The other two plots were burned partially with portions being unburned, lightly burned, and severely burned. These two plots were on steep slopes.

Severe burn findings

Tree mortality was complete. Engelmann spruce had dominated prior to the fire (average cover = 17% dominant/codominant trees; 10% intermediate/suppressed trees; 5% saplings). Subalpine fir dominated the tree understory layer (average cover = 5% poles; 15% saplings). Lodgepole pine cover averaged 5% in the intermediate size category. No tree response was observed after the first growing season.

Fool's huckleberry response was mixed. On the gentle slope the shrub suffered a high mortality with few plants resprouting. Beargrass was present in this stand and vigorously resprouted in the first year from its thick rhizomes.

On the steep slope the fool's huckleberry vigorously resprouted on the severely burned site with 6- to 8-inch sprouts the first year following the burn. The most common herbs on the severely burned sites were fireweeds, arnica, and butterweed (*Senecio streptanthifolius*). The fireweeds were invaders; the others were endurers. The first year following the burn provided an influx by liverworts and mosses on the ash where downed logs had been consumed.

Partial burn findings

The Oregon site (north of Hat Point) was spottily burned with a mosaic resulting of unburned, lightly burned, and severely burned vegetation. This plot was sampled in the fifth year as well as the first year following the burn. The pre-burn stand consisted of Engelmann spruce, subalpine fir, and lodgepole pine dominating the tree overstory as dominant and codominant trees (total cover = 55%) and as intermediate and suppressed trees (cover = 10%). Spruce poles constituted a tree understory cover of 10%. Subalpine fir saplings completed the tree composition at 5% cover.

Heat had singed and browned the leaves of fool's huckleberry the year of the burn. It had also burned about the bases of the shrubs. In the first-year sample the branches were dead and very little basal sprouting was seen. By the fifth year, the shrubs were actively sending up sprouts and had increased to 20% coverage over the 5-year post-burn period. Fool's huckleberry had dominated at 90% coverage prior to the fire. Also noticed in the fifth year were numerous spruce seedlings (5% cover) and a dramatic increase by liverworts and mosses.

The subalpine fir on the site were killed by the fire (either by bark charring or heat from the flames). Douglas-fir and grand fir seedlings were also entering the site in the fifth year as fire seral opportunists. Other invaders taking advantage from the loss of fool's huckleberry were Scouler willow, gooseberries, fireweed, pearly everlasting, bedstraw, skunk-leaved polemonium, and sedges.

Summary

The regime for these cold, moist environments is for long return intervals between fires with stand replacement burning. However, fires burning in these environments often underburn owing to the higher humidities diurnally resulting in partial burns with varying intensities. Fire spread is often by spotting, which can result in a mosaic pattern rather than the continuous consumption of a ground-spreading fire. Subalpine fir is almost always killed along with Engelmann spruce owing to their very thin bark and shallow root systems. Fool's huckleberry is generally considered to be an endurer, and future sampling in the 10th year should support its steady return to site dominance.

Subalpine fir/fool's huckleberry plant association (ABLA2/MEFE) (n=4)

Burn Intensity	---Severe--- (n=2)		-----Partial----- (n=2)		
Species	**PRE**	**1**	**PRE (n=2)**	**1 (n=2)**	**5 (n=1)**
Trees					
subalpine fir (ABLA2)	*28 ◆(20-35)	0	15 (15-15)	0	0
Engelmann spruce (PIEN)	33 (20-46)	0	23 (7-40)	4 (0-7)	5
lodgepole pine (PICO)	5 (0-10)	0	20 (15-25)	5 (0-10)	8
Douglas-fir (PSME)	0	0	7 (0-15)	4 (0-8)	5
Shrubs					
fool's huckleberry (MEFE)	63 (60-65)	1 (1-1)	85 (80-90)	15 (5-25)	20
Scouler willow (SASC)	0	0	0	0	20
gooseberries (RIBES)	0	t (t-t)	0	0	25
big huckleberry (VAME)	1 (t-1)	0	5 (t-10)	3 (3-3)	10
grouse huckleberry (VASC)	3 (t-5)	0	t (0-t)	t (0-t)	0
Perennial Forbs					
heartleaf arnica (ARCO)	1 (0-1)	3 (t-5)	0	0	20
beargrass (XETE)	8 (0-15)	8 (0-15)	0	0	0
pearly everlasting (ANMA)	0	0	0	0	15
skunk-leaved polemonium (POPU)	0	t (0-t)	0	0	5
Annual Forbs					
fireweed (EPAN)	0	3 (1-5)	0	0	45
cleavers (GAAP)	0	0	0	0	5
Litter	40 (20-60)	68 (60-75)	32 (25-40)	63 (25-40)	60
Bare Ground	t (0-t)	13 (5-20)	0	10 (5-15)	1
Moss	55 (40-70)	15 (10-20)	55 (50-60)	18 (5-30)	75
Lichen	3 (t-5)	1 (t-1)	8 (0-15)	0	0

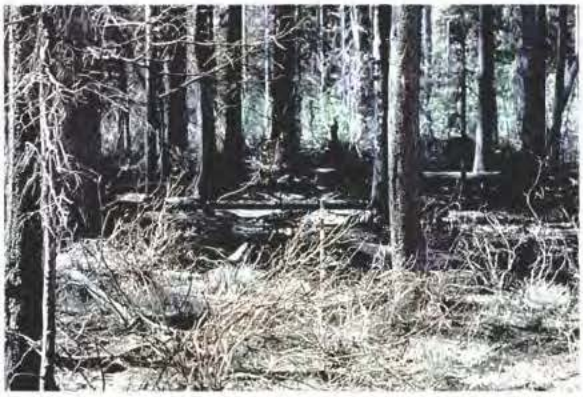
* Average Cover (%)
◆ Range of Cover (%)

ABLA2/MEFE

Plot 7001 Established - 1983 Burned severely - 1994 Rapid River Fire
Bridge Creek, Hells Canyon NRA (Idaho), Wallowa-Whitman National Forest

September 1984 – The pre-burn community was dominated by fool's huckleberry (60%). An herbaceous component was beargrass (15%). The forest overstory was comprised of Engelmann spruce (20%), lodgepole pine (10%), and subalpine fir (5%). Subalpine fir was the only tree species in the understory (15%).

September 1994 – Ten years later, the site burned severely with total tree mortality. Shrubs were moderately burned with stems blackened.



August 1995 – The first year after the fire, fool's huckleberry sprouted from shrub bases. Beargrass also resprouted with coverage equalling its pre-burn abundance (15%). Heartleaf arnica and fireweed occurred at 5% cover each. No tree species had yet re-established.

Subalpine fir/grouse huckleberry plant association (ABLA2/VASC)

Ten plots were used from 4 burns (Summit and Canal Burns in Oregon in 1989, Rapid River in Idaho and Twin Lakes in Oregon in 1994). The Summit and Canal Burn plots were resampled in years 1 and 5; the Rapid River and Twin Lakes plots were resampled the 1st year after the fires. Two of the plots burned with moderate intensity while the other 8 plots were severely burned. Most sites were on gentle slopes (10% or less), above 6300 ft elevation, and burned very intensively.

Severe burn findings

The pre-burn forests were dominated by subalpine fir, Engelmann spruce, and lodgepole pine on the late- to mid-seral plots.

Subalpine fir dominated with overstory crown canopy cover exceeding 25%. Engelmann spruce was a co-dominant with canopy cover averaging 20%. Lodgepole pine was decadent with dominant tree cover averaging 8%. The tree understory was almost exclusively dominated by subalpine fir with average cover of 35%. Spruce also occupied the tree understory with subalpine fir at a low coverage of only 2%.

All trees were killed by stand-replacing fire. Lodgepole pine was re-entering the stands in the fifth year following the burns. Where stands were dominated on gentle flats by Engelmann spruce, the fires burned hottest with very little herbaceous or shrub vegetation present in the fifth year after the fire event. In these plots, bare ground dominated with vegetation comprising small coverages of mosses, liverworts, Ross' sedge, and fireweeds.

Shrubs present in minor amounts in the pre-burn plots and showing a dramatic increase in year 5 were grouse huckleberry and big huckleberry. The only shrub to invade was Scouler willow.

Herbaceous vegetation that demonstrated a marked increase between the first and fifth years after the burns in this plant association were arnica and Ross' sedge. Fireweeds and pearly everlasting were invaders. The fireweeds dramatically increased from 3% to 41% between the first and fifth years after the burns.

Moderate burn findings

One plot was established in a mid-seral community before the fire. It consisted of a dominance by subalpine fir with lodgepole pine associated in the tree overstory. Poles, saplings, and seedlings were present with 20% cover by subalpine fir and spruce.

The other plot was in an early seral community where lodgepole pine dominated the tree overstory (cover = 55%). The only other trees on the plot were saplings and seedlings of subalpine fir and spruce.

All trees were killed by the charring and heat associated with the ground fire. The spruce, subalpine fir, and lodgepole pines in the burns did not survive. In the fifth year following the fires, lodgepole pine was the only tree species to occur on the site.

A dramatic fifth-year increase in shrub cover occurred with grouse huckleberry, gooseberries, and Utah honeysuckle. Scouler willow invaded but at much lower coverages than in the hotter burns.

In these moderately burned sites heartleaf arnica made a greater increase in occupancy than in the severely burned sites. Other herbs notably increasing in year 5 were: Ross' sedge, fireweeds, skunk-leaved polemonium, violets, and Sitka valerian. A notable comparison between these moderately burned sites with the intensively burned sites was that valerian and violets were not as affected by the burn on moderately burned plots and showed healthy increases. Valerian actually was shocked too greatly by the intensive burns and had not rebounded by the fifth year on those sites.

Summary

These ridgetop subalpine fir-spruce dominated communities have a history of stand-replacement burning. Lodgepole pine is the seral tree species that dominates through mid-successional stages and modifies the harsh post-burn sites for emergence of the late-seral subalpine fir.

Grouse huckleberry is nicely adapted to the severity of the fire regimes and is a ready resprouter. It responds more vigorously on light to moderate burns. Opportunists enhancing the early seral composition of these communities are Utah honeysuckle and Scouler willow. Utah honeysuckle present in pre-burn communities was found to sprout on moderate burns.

Dragonhead (*Dracocephalum parviflorum*) entered one site aggressively in the first year after the burn (5%) and increased to 20% by the fifth year. Fire liverwort was often found occupying concavities where logs had burned and moisture collected enhancing its ability to survive on the exposed sites. It occupied from 1 to 5% of the sites.

Subalpine fir/grouse huckleberry plant association (ABLA2/VASC) (n=10)

Burn Intensity	Severe (n=8)			Moderate (n=2)		
Species	**PRE**	1	5	**PRE**	1	5
Trees						
subalpine fir (ABLA2)	*62 ◆(28-85)	0	0	30 (10-50)	0	0
Engelmann spruce (PIEN)	22 (0-46)	0	0	8 (3-21)	0	0
lodgepole pine (PICO)	18 (1-20)	0	10 (3-35)	38 (10-55)	0	15 (10-20)
Shrubs						
grouse huckleberry (VASC)	10 (1-28)	1 (0-3)	12 (3-22)	18 (1-35)	6 (1-10)	35 (10-60)
big huckleberry (VAME)	1 (0-1)	1 (0-1)	5 (0-5)	1 (0-1)	1 (1-1)	3 (0-5)
gooseberries (RIBES)	1 (0-1)	1 (0-1)	2 (0-10)	1 (0-1)	1 (0-1)	8 (0-15)
Utah honeysuckle (LOUT2)	1 (0-1)	1 (0-1)	1 (0-1)	2 (1-3)	1 (1-1)	13 (10-15)
Scouler willow (SASE)	0	8 (0-15)	9 (1-40)	0	0	1 (0-1)
Sedges						
Ross' sedge (CARO)	1 (0-5)	3 (1-10)	10 (5-20)	1 (0-1)	1 (0-1)	8 (0-15)
Perennial Forbs						
heartleaf arnica (ARCO)	7 (0-25)	3 (0-10)	7 (1-15)	8 (5-10)	18 (10-25)	38 (20-55)
hawkweeds (HIAL, HIAL2)	1 (0-1)	1 (0-1)	2 (0-3)	1 (0-1)	3 (1-5)	3 (1-5)
skunk-leaved polemonium (POPU)	2 (0-5)	1 (0-1)	2 (0-5)	1 (0-1)	1 (1-1)	8 (5-10)
Sitka valerian (VASI)	6 (0-10)	1 (0-1)	0	1 (0-1)	1 (0-1)	6 (1-10)
round leaved violet (VIOR2)	2 (0-5)	1 (0-3)	2 (0-3)	1 (1-1)	1 (1-1)	10 (10-10)
pearly everlasting (ANMA)	0	0	6 (0-15)	1 (0-1)	0	2 (1-3)
fireweeds (EPILOB)	0	3 (0-8)	41 (1-90)	1 (0-1)	1 (1-1)	38 (5-70)
Litter	80 (35-95)	50 (0-75)	50 (0-85)	35 (25-45)	65 (45-85)	83 (75-90)
Bare Ground	1 (0-1)	24 (0-80)	14 (0-40)	1 (1-1)	5 (5-5)	13 (5-20)
Mosses and Lichens	17 (0-50)	8 (0-20)	13 (0-35)	55 (50-60)	13 (5-20)	10 (5-15)
Liverworts	0	1 (0-5)	0	0	3 (3-3)	0

* Average Cover (%)
◆ Range of Cover (%)

ABLA2/VASC

Plot 530 **Established - 1980** **Burned severely - 1989** **Summit Fire**
Catch One-Two Trail, Forks of Lightning Creek, Hells Canyon NRA, Wallowa-Whitman National Forest

August 1981 – The forest overstory was composed of subalpine fir (30%), Engelmann spruce (20%), and lodgepole pine (1%). The trees in the understory were subalpine fir (35%) and Engelmann spruce (1%). Grouse huckleberry covered 24% of the site.

August 1989 – The fire killed all trees and burned standing vegetation to the ground surface. Lighter downed woody material was consumed.

ABLA2/VASC

August 1990 – Bare ground dominated the site (27%). Liverworts, fireweeds, heartleaf arnica, and grouse huckleberry were all present at low coverage.

July 1995 – The site, five years later, was totally dominated by fireweeds (19%), grouse huckleberry (18%), and lodgepole pine seedlings (3%). Other plants of note were heartleaf arnica and Ross' sedge at 5% cover each.

Subalpine fir/big huckleberry plant association (ABLA2/VAME)

Eight plant community classification plots were used to study the fire effects in this plant association. These were located on the Summit and Canal Burns (1989) and Twin Lakes and Rapid River Burns (1994). Six plots burned severely while two plots were moderately burned. Slopes averaged 29% and ranged from 5% to 55%. Elevations ranged from 5620 ft to 6770 ft (mean= 6359 ft). Plots were located primarily in the northeast quadrant.

Severe Burn Findings

The six plots severely burned were different structurally and developmentally. Four plots were in late seral stands dominated by spruce. The other two plots were in early seral stands with domination by either Douglas-fir or lodgepole pine. In the late-seral stands, Engelmann spruce canopy cover in the overstory was 25% for dominant/codominant trees and 14% for intermediate/suppressed trees. Subalpine fir overstory cover was 10% for dominant/codominant trees and 4% for intermediate/ suppressed trees. Lodgepole pine was decadent as an overstory member at 11% cover. The tree understory was dominated by subalpine fir poles, saplings, and seedlings at an average of 8% cover.

All overstory trees were killed by stand-replacing fire. The understory trees were also killed by the severe burn. After 5 years the only tree regenerating on the sites was lodgepole pine (half of the sites with a cover of 10%). In one early-seral stand, dominated by lodgepole pine in the pre-burn community, lodgepole pine again dominated after 5 years (80% cover).

Decreasing following the burn were prince's pine and Utah honeysuckle. Increasing after 5 years was big huckleberry after an initial decline found in the first-year sampling. In the early seral plot dominated by lodgepole pine, a 5-fold increase by spiraea and grouse huckleberry resulted from the fire. Plants entering the post-burn community in the fifth year, which were not part of the pre-burn plant community, were Scouler willow, sticky currant, and swamp gooseberry.

Decreasing in the intense burns was sidebells pyrola while increasers were heartleaf arnica and Ross' sedge. Fireweeds, which had entered the burn area in the first year, had increased on all sites by the fifth year. Pearly everlasting was not found in the first year after the burn but was present in four of the six intensely burned sites in the fifth year sample. Long stalked clover was prominent (35% cover) in the fifth year sampling of the early seral lodgepole pine-dominated plot.

Bare ground increased dramatically on the intense burn sites (0% in pre-burn; 21% in first-year post-burn samples; 13% in fifth-year samples). Litter cover consequently declined from 92% in pre-burn communities sampled: 66% in the first year after the burn, 63% in the fifth year following the burn. Mosses dramatically increased following the burn (4% pre-burn; 6% first year after the burn; and 18% in the fifth year following the burn). Fire liverworts entered the sites on intensely burned areas increasing from 1 to 5%.

Moderate burn findings

The 2 plots used have only been sampled for first-year post-burn results to date. The stands were both late seral communities dominated by subalpine fir and spruce. Subalpine fir dominated the tree overstory with an average of 17% canopy cover in dominant/codominant and intermediate/suppressed layers. Engelmann spruce provided an average overstory crown cover of 6%. Understory trees were few with subalpine saplings/seedlings prominent at 5% cover. The spruce were all killed and most of the subalpine fir succumbed.

In this moderate burn, big huckleberry declined from 58% to 18% cover. Other shrubs declining were prince's pine, Utah honeysuckle and grouse huckleberry. Among the herbaceous vegetation, sidebells pyrola decreased; heartleaf arnica and round-leaved violet remained constant; and Sitka valerain increased.

Predictably bare ground increased from 0% to 9% in the first year with a concurrent decline in litter cover from 90% to 75%. Mosses doubled in coverage from 6% to 12%.

Summary

These mountain slope subalpine fir - spruce dominated communities are often replaced by fire when it occurs. Lodgepole pine is the fire seral species most often capitalizing on the stand-replacing event. Under fire regimes where fire can perform within its regular interval, these communities have been the recipients of cooler underburns. Wider spacing of overstory trees with less ingrowth by understory saplings and pole-sized material has historically resulted in less stand replacement burning of these north-aspect, higher elevation communities. Big huckleberry was killed by duff-consuming intense burns, however it readily sprouted and vigorously returned where burning was light to moderate. Opportunists with the stand replacement event were Scouler willow, fireweeds, and pearly everlasting. These can form dense patches and add diversity to the coniferous forest landscape.

Subalpine fir/big huckleberry plant association (ABLA2/VAME) (n=8)

Burn Intensity	---Severe--- (n=6)			---Moderate--- (n=2)	
Species	**PRE**	**1**	**5**	**PRE**	**1**
Trees					
subalpine fir (ABLA2)	*22 ◆(10-35)	0	0	40 (40-41)	8 (0-16)
Engelmann spruce (PIEN)	24 (3-40)	0	0	5 (4-6)	0
lodgepole pine (PICO)	7 (0-40)	0	32 (3-80)	0	0
Douglas-fir (PSME)	7 (0-40)	0	0	5 (0-10)	0
Shrubs					
big huckleberry (VAME)	17 (1-45)	2 (0-5)	13 (10-15)	58 (40-75)	18 (15-20)
grouse huckleberry (VASC)	7 (0-8)	1 (0-1)	12 (0-35)	8 (1-15)	3 (0-5)
birchleaf spiraea (SPBE)	t (0-1)	1 (0-5)	4 (0-15)	0	0
Utah honeysuckle (LOUT2)	1 (1-1)	t (0-1)	1 (0-3)	3 (1-5)	1 (0-1)
prince's pine (CHUM)	3 (0-10)	0	0	2 (0-3)	1 (0-1)
Scouler willow (SASC)	0	7 (0-45)	8 (0-10)	0	0
sticky current (RIVI)	t (0-1)	t (0-1)	9 (0-15)	0	0
swamp gooseberry (RILA)	t (0-1)	1 (0-1)	3 (0-3)	0	0
Sedges					
Ross' sedge (CARO)	t (0-1)	1 (0-1)	3 (0-5)	1 (0-1)	1 (1-1)
Perennial Forbs					
sidebells pyrola (PYSE)	3 (0-5)	t (0-1)	0	3 (1-5)	1 (1-1)
heartleaf arnica (ARCO)	9 (0-15)	5 (0-20)	14 (0-30)	1 (1-1)	1 (1-1)
pearly everlasting (ANMA)	0	0	5 (0-10)	0	0
round-leaved violet (VIOR2)	6 (0-16)	t (0-5)	t (0-5)	3 (0-5)	3 (0-5)
Sitka valerian (VASI)	t (0-1)	0	0	1 (1-1)	3 (3-3)
fireweeds (EPILO)	0	1 (0-1)	23 (5-50)	0	t (0-1)
Litter	92 (84-95)	66 (45-85)	63 (20-85)	90 (85-95)	75 (65-85)
Bare Ground	0	21 (1-40)	13 (4-40)	t (0-1)	8 (0-15)
Moss	4 (1-15)	6 (1-15)	18 (10-35)	6 (3-10)	12 (10-15)

* Average Cover (%)
◆ Range of Cover (%)

ABLA2/VAME
Plot 534 **Established - 1980** **Burned severely - 1989** **Summit Fire**
Summit Ridge, Hells Canyon NRA, Wallowa-Whitman National Forest

September 1980 –The pre-burn forest overstory was dominated by subalpine fir (30%) and Engelmann spruce (15%). Subalpine fir was the dominant tree in the understory (5%). Big huckleberry was the dominant shrub (19%) with grouse huckleberry associated (8%). The most common forb was heartleaf arnica (2%).

August 1989 – All trees were killed, shrubs burned to the ground surface, and lighter down woody material was consumed by the fire.

ABLA2/VAME

August 1990 – The first growing season after the fire, bare ground was prevalent (28%). Shrubs (big huckleberry, grouse huckleberry) and herbaceous plants (heartleaf arnica, Ross' sedge, and fireweeds) were all present at only 1% cover each.

July 1995 – Five years after the fire, the dominant plant was fireweed (23%). Rapidly increasing were big huckleberry (13%), heartleaf arnica (6%), and Ross' sedge (5%). Lodgepole pine was now establishing as the pioneering tree species (3%).

Subalpine fir/beadlily plant association (ABLA2/CLUN)

Two plots were used from two different burns (Teepee Butte 1988; Twin Lakes 1994). The Teepee Butte plot was burned severely and was sampled the first and fifth years after the fire. The Twin Lakes plot was moderately burned and was resampled the first year following the fire. Both plots had northerly aspects and were located on gentle slopes (5% and 12%) adjacent to riparian vegetation at canyon bottom sites.

Severe burn findings

The severe-burn plot was at an early-mid seral stage of development. Larch dominated the overstory (10% cover) with spruce (20% cover). Both spruce and subalpine fir poles, saplings, and seedlings constituted the tree understory (combined cover of 25%).

All trees were killed by stand-replacing fire. In the fifth year sample, lodgepole pine was occupying 80% of the site. It had been a prominent tree understory component in the pre-burn community at 40%.

Big huckleberry had been present at 30% cover, was eliminated by the fire, and returned by the fifth year with 5% cover. Twinflower was eliminated by the burn. Actively entering the plot following the intense burn were black elderberry and Scouler willow (both present at 10% cover in the fifth year after the burn.

Herbaceous vegetation declining with the burn in the first-year sample were goldthread, round-leaved violet, meadowrue, heartleaf arnica and beadlily. By the fifth year heartleaf arnica had doubled its coverage to 80%; beadlily had rebounded with 20% coverage; and meadowrue was present at 5% cover.

Plants entering the community as a result of the fire were fireweeds, clover, and pearly everlasting. Pearly everlasting was not present until the fifth year sample. No species increased as a result of the fire.

Litter cover declined, bare ground increased, and mosses declined from the burn.

Moderate burn findings

The moderately burned plot was in a spruce-dominated stand. The tree canopy cover was dominated by spruce with 75% cover. Subalpine fir was the only other tree species of note with its only presence in saplings and seedlings at 10% cover. All trees were killed by the burn.

Big huckleberry was prominent at 20% cover in the pre-burn plot but was absent in the first-year resample following the burn. Shrubs entering as a result of the burn were Scouler willow and black elderberry.

Herbaceous vegetation declining were meadowrue, heartleaf arnica, and beadlily. Beadlily and meadowrue were not found in the first-year resample after the burn. Increasing were Columbia brome and heartleaf arnica. An invader to the site after the fire was stinging nettle (5% cover).

Litter and bare ground coverages did not appreciably change. Mosses and lichens declined as a group.

Summary

These cold-air ponding sites are especially supportive of lodgepole pine when the late- and mid-seral communities are modified by stand-replacement burns. Black elderberry and Scouler willow provide enhancement to the coniferous forest by enriching the community with a hardwood component and a different structure to the forest understory. Columbia brome is stimulated by moderate and lighter burning in this plant association.

Subalpine fir/beadlily plant association (ABLA2/CLUN) (n=2)

Burn Intensity	---Severe--- (n=1)			---Moderate--- (n=1)	
Species	**PRE**	**1**	**5**	**PRE**	**1**
Trees					
subalpine fir (ABLA2)	*10	0	0	10	0
Engelmann spruce (PIEN)	35	0	0	75	0
lodgepole pine (PICO)	40	0	80	0	0
Shrubs					
big huckleberry (VAME)	30	0	5	20	0
twinflower (LIBO2)	5	0	0	0	0
Scouler willow (SASC)	0	10	10	0	15
black elderberry (SARA)	0	1	10	0	3
swamp gooseberry (RILA)	1	1	1	0	0
Sedges/Grasses					
Columbia brome (BRVU)	1	0	0	1	25
Ross' sedge (CARO)	5	10	3	0	1
Perennial Forbs					
beadlily (CLUN)	15	1	20	10	0
meadowrue (THOC)	10	1	5	3	0
goldthread (COOC2)	25	1	1	0	0
round-leaved violet (VIOR2)	10	5	0	15	20
heartleaf arnica (ARCO)	40	30	80	30	5
pearly everlasting (ANMA)	0	0	10	0	0
Annual Forbs					
fireweeds (EPAN, EPPA)	0	4	11	0	1
Litter	90	70	80	55	50
Bare Ground	0	1	15	1	1
Moss	15	15	5	40	15
Lichen	0	0	0	1	10

* Average Cover (%)

ABLA2/CLUN

Plot 311 **Established - 1979** **Burned severely - 1988** **Teepee Butte Fire**

Poison Point Creek, Hells Canyon NRA, Wallowa-Whitman National Forest

July 1979 – The forest overstory was dominated by Engelmann spruce (20%) and western larch (10%). The understory trees were lodgepole pine (40%), Engelmann spruce (15%), and subalpine fir (10%). Shrubs were dominated by big huckleberry (30%) and twin flower (5%). The herbaceous composition was rich with heartleaf arnica (40%), beadlily (15%), goldthread (25%), and meadowrue (10%).

October 1988 – All trees were killed by the severe burn. Shrubs were burned to the ground surface or resulted in charred, black stems without branches.

July 1995 - Five years after the fire, heartleaf arnica dominated (80%) with beadlily (20%), fireweeds (11%), clover (10%), and pearly everlasting (10%) associated in the herbaceous layer. Shrubs pioneering following the burn were Scouler willow (10%) and black elderberry (10%). Lodgepole pine seedlings carpeted the site.

Subalpine fir/arrowleaf groundsel plant association (ABLA2/SETR)

A plot established to characterize this plant association was severely burned by the Rapid River Fire in 1994. The plot is located in the Seven Devils Mtns. at 7180 ft on a southeast aspect with a 15% slope. The data presented from this plot are from prior to the fire and the first year following the burn.

Severe Burn Findings

Spruce dominated this plot with an overstory canopy cover of 45%. Subalpine fir and lodgepole pine were weakly present in the overstory at a combined 5%. Very little tree understory occurred beneath the dense spruce overstory. Total understory tree cover was 5%.

All trees (subalpine fir, Engelmann spruce) were killed by the fire. After 1 year no new trees had established.

Shrubs were weakly present in the late seral community preceding the fire. Only swamp currant was present the year after the burn. It was not present in the pre-burn community.

Herbaceous plants increased the year after the burn. Heartleaf arnica, roundleaf violet, and meadowrue all increased in cover. Entering the site as a new occupant was alpine fireweed. Arrowleaf groundsel occupied a portion of the plot that escaped the burn and did not lose or gain from the fire.

Summary

The burned area where fire was intense was covered by heartleaf arnica and meadowrue. Bearberry honeysuckle was killed by the intense burn. However where it occurred and fire had burned moderately or lightly the shrub was found to resprout.

Subalpine fir/arrowleaf groundsel plant association (ABLA2/SETR) (n=1)

Burn Intensity	Severe (n=1)	
Species	**PRE**	**1**
Trees		
subalpine fir (ABLA2)	*7	0
Engelmann spruce (PIEN)	45	0
Shrubs		
Utah honeysuckle (LOUT2)	1	0
swamp gooseberry (RILA)	0	1
bearberry honeysuckle (LOIN)	0	1
Perennial Forbs		
heartleaf arnica (ARCO)	10	15
meadowrue (THOC)	1	10
violets (VIOR2, VIGL)	1	2
arrowleaf groundsel (SETR)	1	1
alpine willowweed (EPAL)	0	1
monkshood (ACCO)	t	5
Litter	95	95
Bare Ground	0	1
Moss	1	1
Liverworts	0	1

* Average Cover (%)

Subalpine fir/false bugbane plant association (ABLA2/TRCA3)

One plot established to characterize this plant association was burned severely by the Twin Lakes Fire of 1994. It is located north of Twin Lakes below the rim overlooking the Imnaha River canyon. The plot is on a 10% slope at 5890 ft elevation and has a northeasterly aspect.

Severe Burn Findings

The stand was dominated by Engelmann spruce with 40% canopy cover. Subalpine fir was present in trace coverage as an understory member where spruce dominated at only 3% cover. All the trees were killed by the fire.

Shrub coverage increased with the entry into the community by Scouler willow and black elderberry. Thimbleberry was unaffected by this burn.

In the first year after the burn herbaceous vegetation had declined from the fire. Declining were heartleaf arnica and false bugbane. Interestingly species that had increased in moderate burns of vegetation pertaining to plant associations with similar herbaceous composition in cool, moist subalpine fir forests were killed by this severe burn. These included Columbia brome, woods strawberry, meadowrue, and roundleaved violet.

Litter cover declined and bare ground increased. Mosses made a six-fold increase to 60% coverage of the site and fire liverworts entered after this fire with a cover of 5%.

Summary

On that portion of the plot where fire burned hottest, fireweeds dominated. Fireweed (*Epilobium angustifolium*) and tall annual willowweed (*E. paniculatum*) occupied 18% of the plot. Scouler willow was present with black elderberry on the portion of the plot where fire had burned less severely. Fire liverworts and mosses occupied an impressive 65% of the ground surface on this intensely burned site. This was probably due to the vernally moist soils prevalent in the subalpine fir/false bugbane plant association.

Subalpine fir/false bugbane plant association (ABLA2/TRCA3) (n=1)

Burn Intensity	------Severe------ (n=1)	
Species	**PRE**	**1**
Trees		
subalpine fir (ABLA2)	***1**	0
Engelmann spruce (PIEN)	**43**	0
Shrubs		
thimbleberry (RUPA)	**1**	1
Scouler willow (SASC)	**0**	10
black elderberry (SARA)	**1**	5
Grasses/Sedges		
Columbia brome (BRVU)	**10**	0
Ross' sedge (CARO)	**1**	1
Perennial Forbs		
false bugbane (TRCA3)	**20**	1
heartleaf arnica (ARCO)	**30**	1
pearly everlasting (ANMA)	**1**	1
woods strawberry (FRVE)	**10**	0
meadowrue (THOC)	**15**	0
violets (VIOLA)	**15**	0
fireweed (EPAN)	**0**	15
Annual Forbs		
tall annual willowweed (EPPA)	**0**	3
Litter	**85**	20
Bare Ground	**1**	10
Moss	**10**	60
Liverworts	**0**	5

* Average Cover (%)

Literature Cited

Adams, Glenn R. 1989. Why Burn Rangelands? In Proceedings of Prescribed Fire in the Intermountain Region: pp. 101-102. Cooperative Extension, Washington State University, Pullman, Washington.

Agee, J.K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press. Washington, D.C.

Agee, J.K. 1996. Fire in the Blue Mountains: a history, ecology, and research agenda. In: Search for a solution: pp. 119-145. American Forests. Washington, D.C.

Arno, S.F., D.G. Simmerman, and R.E. Keane. 1985. Forest Succession on four habitat types in western Montana. USDA For. Serv. Gen. Tech. Report INT-177. Ogden, Utah.

Boyer, D.E. and J.D. Dell. 1980. Fire Effects of Pacific Northwest Soils. Watershed and Aviation Management. USDA - US Forest Service, Portland. Oregon.

Bunting, S.C. 1996. Effects of Prescribed Fire on Rangeland Shrubs in the Intermountain Region. In Proceedings of Prescribed Fire in the Intermountain Region: pp. 103-106. Cooperative Extension, Washington State University, Pullman, Washington.

Burkhardt, J.W. and E.W. Tisdale. 1976. Causes of Juniper Invasion in Southwestern Idaho. Ecology 57:472-484.

Fischer, W.C., M. Miller, C.M. Johnston, J.K. Smith, D.G. Simmerman, and J.K. Brown. 1996. Fire Effects Information System and User's Guide. Gen. Tech. Report INT-GTR-327. USDA-Forest Service. Intermountain Research Station. Ogden, Utah. 130 pp.

Flanagan, P. 1996. Survival of Fire-Injured Conifers. Fire Management Notes 56(2). pp. 13-16. USDA - Forest Service, Washington, D.C.

Hall, F.C. 1980. Fire History - Blue Mountains, Oregon. In Proceedings of the Fire History Workshop. pp. 75-81. Gen. Tech. Report GTR-RM-81. USDA-Forest Service. Fort Collins, Colorado.

Johansen, J.R. and W.R. Rayburn. 1996. Effects of Range Fires on Soil Cryptogamic Crusts. In Proceedings of Prescribed Fire in the Intermountain Region. pp. 107-109. Cooperative Extension, Washington State University, Pullman, Washington. 399 pp.

Johnson, C.G. 1994. Forest Health in the Blue Mountains: A Plant Ecologist's Perspective on Ecosystem Processes and Biological Diversity. Gen.Tech. Report PNW-GTR-339. USDA-Forest Service. PNW Research Station. Portland, Oregon. 23 pp.

Johnson, C.G. and R. Clausnitzer. 1992. Plant Associations of the Blue and Ochoco Mountains. R6-ERW-TP-036-92. USDA- Forest Service, PNW Region, Portland, Oregon. 208 pp.

Johnson, C.G.; Clausnitzer, R.R.; Mehringer, P.J.; Oliver, C.D. 1994. Biotic and Abiotic Processes of Eastside Ecosystems: the Effects of Management on Plant and Community Ecology, and on Stand and Landscape Vegetation Dynamics. Gen. Tech. Report PNW-GTR-322. USDA-Forest Service. PNW Research Station. Portland, Oregon. 72 pp.

Johnson, C.G. and S. Simon. 1987. Plant Associations of the Wallowa-Snake Province. USDA - Forest Service, PNW Region, R6-ECOL-TP-225A-86. 399 pp.

McLean, A. 1969. Fire Resistance of Forest Species as Influenced by Root Systems. J. Range Mgmt. 22:120-122.

Morrison, P. and F.J. Swanson. 1990. Fire History and Pattern in a Cascade Range Landscape. Gen. Tech. Report PNW-GTR-254. USDA-Forest Service. PNW Research Station. Portland, Oregon.

National Park Service. 1992. Western Regional Fire Monitoring Handbook.

Ryan, K.C. and N.V. Noste. 1985. In Proceedings - symposium and workshop on wilderness fire. Missoula, Montana. USDA-Forest Service. Gen. Tech. Rep. INT-182. Ogden, Utah. pp. 230-238.

Scott, D.W.; J. Szymoniak; and V. Rockwell. Entomological Concerns Regarding Burn Characteristics and Fire Effects on Tree Species During Prescribed Landscape Burns. BMZ-97-1. USDA-Forest Service. Pacific Northwest Region. Wallowa-Whitman NF, Baker City, Oregon. 49 pp.

Shinn, D.A. 1980. Historical Perspectives on Range Burning in the Inland Pacific Northwest. J. of Range Management 33(6): 415-423.

Strang, R.M. 1989. Impacts of Fire on Herbaceous Vegetation. pp. 111-112. In Proceedings of Prescribed Fire in the Intermountain Region. Cooperative Extension, Washington State University, Pullman, Washington. 399 pp.

APPENDIX A. Species List (by Scientific Name)

SCIENTIFIC NAME	COMMON NAME	R6 CODE	PLANTS CODE
TREES			
Abies grandis	Grand Fir	ABGR	ABGR
Abies lasiocarpa	Subalpine Fir	ABLA2	ABLA
Larix occidentalis	Western Larch	LAOC	LAOC
Picea engelmannii	Engelmann Spruce	PIEN	PIEN
Pinus contorta	Lodgepole Pine	PICO	PICO
Pinus ponderosa	Ponderosa Pine	PIPO	PIPO
Pseudotsuga menziesii	Douglas Fir	PSME	PSME
SHRUBS			
Acer glabrum	Rocky Mountain Maple	ACGL	ACGL
Alnus sinuata	Sitka Alder	ALSI	ALSI3
Alnus spp.	Alder	ALNUS	ALNUS
Amelanchier alnifolia	Western Serviceberry	AMAL	AMAL2
Arctostaphylos nevadensis	Pinemat Manzanita	ARNE	ARNE
Arctostaphylos uva-ursi	Bearberry	ARUV	ARUV
Artemisia tridentata	Big Sagebrush	ARTR	ARTR2
Artemisia tridentata vaseyana	Mountain Big Sagebrush	ARTRV	ARTRV
Berberis repens	Low Oregongrape	BERE	BERE
Berberis spp	Oregongrape	BERBE	BERBE
Ceanothus sanguineus	Redstem Ceanothus	CESA	CESA
Ceanothus spp.	Ceanothus	CEANO	CEANO
Ceanothus velutinus	Snowbrush Ceanothus/Buckbrush	CEVE	CEVE
Cercocarpus ledifolius	Curlleaf Mountain Mahogany	CELE	CELE3
Chimaphila menziesii	Little Prince's Pine/Pipissewa	CHME	CHME
Chimaphila umbellata	Common Prince's Pine	CHUM	CHUM
Chrysothamnus nauseosus	Gray Rabbitbrush	CHNA	CHNA2
Chrysothamnus viscidiflorus	Green Rabbitbrush	CHVI	CHVI8
Holodiscus discolor	Creambush Oceanspray	HODI	HODI
Linnaea borealis	American Twinflower	LIBO2	LIBO3
Lonicera involucrata	Bearberry Honeysuckle/Black Twinberry	LOIN	LOINS
Lonicera utahensis	Utah Honeysuckle	LOUT2	LOUT2
Menziesia ferruginea	Fool's Huckleberry	MEFE	MEFE
Pachistima myrsinites	Oregon Boxwood	PAMY	PAMY
Philadelphus lewisii	Lewis Mockorange/Syringa	PHLE2	PHLE4
Physocarpus malvaceus	Mallow Ninebark	PHMA	PHMA5
Potentilla fruitcosa	Bush/Shrubby Cinquefoil	POFR	POFR4
Purshia tridentata	Antelope Bitterbrush	PUTR	PUTR2
Rhus glabra	Smooth Sumac	RHGL	RHGL
Rhus radicans	Poison Ivy, Poison Oak	RHRA	RHRA6
Ribes cereum	Wax or Squaw Currant	RICE	RICE
Ribes lacustre	Prickly Currant/Swamp Gooseberry	RILA	RILA
Ribes spp.	Currant or Gooseberry	RIBES	RIBES
Ribes viscosissimum	Sticky Currant	RIVI	RIVI3
Rosa gymnocarpa	Baldhip Rose	ROGY	ROGY
Roas spp.	Rose	ROSA	ROSA5
Rosa woodsii	Wood's Rose	ROWO	ROWO
Rubus idaeus	Red Raspberry	RUID	RUID
Rubus parviflorus	Western Thimbleberry	RUPA	RUPA
Salix bebbiana	Bebb Willow	SABE	SABE2
Salix boothii	Booth Willow	SABO2	SABO2

SCIENTIFIC NAME	COMMON NAME	R6 CODE	PLANTS CODE
Salix scouleriana	Scouler Willow	SASC	SASC
Salix spp.	Willow	SALIX	SALIX
Sambucus cerulea	Blueberry Elder	SACE	SACE3
Sambucus racemosa	Black Elderberry	SARA	SARA2
Sambucus spp.	Elderberry	SAMBU	SAMBU
Shepherdia canadensis	Soapberry/Canada Buffaloberry	SHCA	SHCA
Sorbus scopulina	Cascade Mountain Ash	SOSC2	SOSC2
Spiraea betulifolia	Birch/Shiny Leaf Spiraea	SPBE	SPBE2
Symphoricarpos albus	Common Snowberry	SYAL	SYAL
Symphoricarpos oreophilus	Mountain Snowberry	SYOR	SYOR2
Symphoricarpos spp.	Snowberry	SYMPH	SYMPH
Tetradymia canescens	Gray Horsebrush	TECA	TECA2
Vaccinium membranaceum	Big Huckleberry	VAME	VAME
Vaccinium scoparium	Grouse Huckleberry/Whortleberry	VASC	VASC
FORBS			
Achillea millefolium	Common Yarrow	ACMI	ACMI2
Aconitum columbianum	Columbia Monkshood	ACCO	ACCO4
Actaea rubra	Wild Red Baneberry	ACRU	ACRU2
Adenocaulon bicolor	Trail/Pathfinder Plant	ADBI	ADBI
Agastache urticifolia	Nettleleaf Horsemint	AGUR	AGUR
Agoseris glauca	Pale Agoseris	AGGL	AGGL
Agoseris grandiflora	Large-flower Agoseris	AGGR	AGGR
Agoseris heterophylla	Annual Agoseris	AGHE	AGHE2
Agoseris spp.	Agoseris	AGOSE	AGOSE
Allium acuminatum	Tapertip Onion	ALAC	ALAC4
Allium spp.	Onion	ALLIU	ALLIU
Allium tolmiei	Tolmie's Onion	ALTO	ALTO
Allium tolmiei platyphyllum	Tolmie's Onion	ALTOP	ALTOP2
Alyssum alyssoides	Pale Alyssum	ALAL	ALAL3
Amaranthus spp.	Pigweed	AMARA	AMARA
Amsinckia retrorsa	Rigid Fiddleneck	AMRE2	AMRE2
Amsinckia spp.	Fiddleneck	AMSIN	AMSIN
Anaphalis margaritacea	Common Pearly-everlasting	ANMA	ANMA
Anchusa spp.	Bigloss	ANCHU	ANCHU
Anemone piperi	Windflower	ANPI	ANPI
Antennaria anaphaloides	Tall Pussytoes	ANAN	ANAN2
Antennaria dimorpha	Low Pussytoes	ANDI	ANDI2
Antennaria luzuloides	Woodrush Pussytoes	ANLU	ANLU2
Antennaria microphylla	Rosy Pussytoes	ANMI2	ANMI3
Antennaria racemosa	Slender Pussytoes	ANRA	ANRA
Antennaria spp.	Pussytoes	ANTEN	ANTEN
Antennaria stenophylla	Narrow-leaf Pussytoes	ANST	ANST2
Apocynum androsaemifolium	Spreading Dogbane	APAN	APAN2
Apocynum androsaemifolium pumilum	Spreading Dogbane	APANP	APANP
Aquilegia formosa	Sitka/Red Columbine	AQFO	AQFO
Arabis hirsuta	Hairy Rockcress	ARHI	ARHI
Arabis hirsuta glabrata	Hairy Rockcress	ARHIG	ARHIG
Arabis holboellii	Holboell's Rockcress	ARHO	ARHO2
Arabis lignifera	Woodybranch Rockcress	ARLI	ARLI
Arabis spp.	Rockcress	ARABI	ARABI2
Arenaria congesta	Ballhead/Capitate Sandwort	ARCO2	ARCO5
Arenaria macrophylla	Bigleaf Sandwort	ARMA3	ARMA18

SCIENTIFIC NAME	COMMON NAME	R6 CODE	PLANTS CODE
Arenaria serpyllifolia	Thyme-leaf Sandwort	ARSE	ARSE2
Arenaria spp.	Sandwort	ARENA	ARENA
Arnica cordifolia	Heartleaf Arnica	ARCO	ARCO9
Arnica latifolia	Mountain Arnica	ARLA	ARLA8
Arnica latifolia latifolia	Mountain Arnica	ARLAL	UNASSGND
Arnica sororia	Twin Arnica	ARSO	ARSO2
Arnica spp.	Arnica	ARNIC	ARNIC
Artemisia ludoviciana	Western mugwort	ARLU	ARLU
Aster conspicuus	Showy Aster	ASCO	ASCO3
Aster perelegans	Elegant Aster	ASPE	ASPE3
Aster spp.	Aster	ASTER	ASTER
Astragalus canadensis	Canada Milkvetch	ASCA7	ASCA11
Astragalus cusickii	Cusick's Milkvetch	ASCU4	ASCU5
Astragalus inflexus	Hairy Milkvetch	ASIN2	ASIN5
Astragalus reventus sheldonii	Sheldon's Milkvetch	ASRES	ASRES
Astragalus spp.	Milkvetch	ASTRA	ASTRA
Avena fatua	Wild Oats	AVFA	AVFA
Balsamorhiza incana	Woolly Balsamroot	BAIN	BAIN
Balsamorhiza sagittata	Arrowleaf Balsamroot	BASA	BASA3
Balsamorhiza serrata	Serrated Balsamroot	BASE	BASE2
Besseya rubra	Red Kittentail/Red Besseya	BERU	BERU
Blepharipappus scaber	Blepharipappus	BLSC	BLSC
Borago spp.	Borage	BORAG	BORAG
Brodiaea douglasii	Douglas' Brodiaea	BRDO	BRDO
Calochortus elegans	Elegant Mariposa	CAEL	CAEL
Calochortus macrocarpus	Sagebrush Mariposa	CAMA	CAMA5
Calochortus spp.	Mariposa or Sego Lily	CALOC	CALOC
Camassia quamash	Common Camas	CAQU	CAQU2
Capsella bursa-pastoris	Shepherd's Purse	CABU	CABU2
Castilleja applegatei	Wavy-leaved Paintbrush	CAAP2	CAAP4
Castilleja hispida	Harsh Paintbrush	CAHI2	CAHI9
Castilleja miniata	Scarlet Paintbrush	CAMI2	CAMI12
Castilleja spp.	Paintbrush	CASTI	CASTI2
Cerastium arvense	Field Chickweed	CEAR	CEAR4
Cerastium spp.	Chickweed	CERAS	CERAS
Cerastium viscosum	Sticky Chickweed	CEVI	CEVI3
Cerastium vulgatum	Big Chickweed	CEVU	CEVU
Chenopodium fremontii	Fremont's Lamb's Quarters	CHFR	CHFR3
Chrysopsis villosa	Hairy Golden Aster	CHVI2	CHVI10
Circaea alpina	Enchanter's Nightshade	CIAL	CIAL
Cirsium arvense	Canada Thistle	CIAR	CIAR4
Cirsium spp.	Thistle	CIRSI	CIRSI
Cirsium vulgare	Bull/Common Thistle	CIVU	CIVU
Clarkia pulchella	Deerhorn/Pink Fairies	CLPU	CLPU
Clarkia rhomboidea	Common Clarkia	CLRH	CLRH
Clintonia uniflora	Queen's Cup Beadlily	CLUN	CLUN2
Collinsia grandiflora	Large-flowered Collinsia	COGR	COGR2
Collinsia parviflora	Small-flowered Blue-eyed Mary	COPA	COPA3
Collomia grandiflora	Large-flowered Collomia	COGR2	COGR4
Collomia linearis	Narrow-leaf Collomia	COLI2	COLI2
Collomia spp.	Collomia	COLLO	COLLO
Conyza canadensis	Horseweed	COCA2	COCA5
Conyza canadensis glabrata	Horseweed	COCAG	COCAG
Conyza spp.	Horseweed	CONYZ	CONYZ
Coptis occidentalis	Western Goldthread	COOC2	COOC

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Corallorhiza maculata	Spotted Coral Root	COMA3	COMA4
Crepis acuminata	Long-leaved/Tapertip Hawksbeard	CRAC	CRAC2
Crepis atrabarba	Slender Hawksbeard	CRAT	CRAT
Crepis spp.	Hawksbeard	CREPI	CREPI
Cryptantha affinis	Slender Cryptantha	CRAF	CRAF
Cryptantha flaccida	Weak-stemmed Cryptantha	CRFL	CRFL4
Cryptantha intermedia	Common Cryptantha	CRIN2	CRIN8
Cryptantha interrupta	Bristly Cryptantha	CRIN3	CRIN9
Cryptantha simulans	Pinewoods Cryptantha	CRSI	CRSI2
Cryptantha torreyana	Torrey's Cryptantha	CRTO	CRTO4
Cymopterus terebinthinus foeniculaceus	Turpentine Cymopterus	CYTEF	CYTEF
Cynoglossum occidentale	Western Houndstongue	CYOC	CYOC
Cynoglossum officinale	Common Houndstongue	CYOF	CYOF
Cystopteris fragilis	Brittle Bladderfern	CYFR	CYFR2
Delphinium bicolor	Little Larkspur	DEBI	DEBI
Delphinium depauperatum	Slim/Dwarf Larkspur	DEDE	DEDE2
Delphinium nuttallianum	Upland Larkspur	DENU3	DENU2
Delphinium spp.	Larkspur	DELPH	DELPH
Descurainia pinnata	Pinnate Tansymustard	DEPI	DEPI
Descurainia richardsonii	Mountain Tansymustard	DERI	DERI2
Descurainia richardsonii sonnei	Mountain Tansymustard	DERIS	DERIS
Disporum trachycarpum	Wartberry Fairybells	DITR	DITR2
Dodecatheon spp.	Shooting-star	DODEC	DODEC
Draba verna	Spring Whitlow-grass	DRVE2	DRVE2
Dracocephalum parviflorum	Dragonhead	DRPA	DRPA2
Epilobium alpinum	Alpine Willow-weed	EPAL	EPAL
Epilobium angustifolium	Fireweed	EPAN	EPAN2
Epilobium glaberrimum	Smooth Willow-weed	EPGL	EPGL
Epilobium glaberrimum fastigiatum	Smooth Willow-weed	EPGLF	EPGLF2
Epilobium glandulosum	Common Willow-weed	EPGL2	EPGL4
Epilobium minutum	Small-fld Willow-weed	EPMI	EPMI
Epilobium paniculatum	Tall Annual Willow-weed	EPPA	EPPA2
Epilobium spp.	Willow-weed	EPILO	EPILO
Epilobium watsonii	Watson's Willow-weed	EPWA	EPWA3
Epilobium watsonii occidentale	Watson's Willow-weed	EPWAO	EPWAO2
Erigeron chrysopsidis	Dwarf Yellow Fleabane	ERCH	ERCH4
Erigeron filifolius	Threadleaf Fleabane	ERFI	ERFI2
Erigeron inornatus	Rayless Daisy	ERIN2	ERIN2
Erigeron peregrinus	Subalpine Daisy	ERPE	ERPE3
Erigeron pumilus	Shaggy Fleabane	ERPU	ERPU2
Erigeron speciosus	Showy Fleabane	ERSP	ERSP4
Erigeron spp.	Daisy or Fleabane	ERIGE	ERIGE2
Eriogonum compositum	Northern Buckwheat	ERCO5	ERCO12
Eriogonum cusickii	Cusick's Buckwheat	ERCU	ERCU3
Eriogonum flavum	Golden Buckwheat	ERFL	ERFL4
Eriogonum heracleoides	Wyeth's Creamy Buckwheat	ERHE	ERHE2
Eriogonum spp.	Buckwheat	ERIOG	ERIOG
Eriophyllum lanatum	Common Eriophyllum/Woolly Sunflower	ERLA	ERLA6
Erodium cicutarium	Stork's Bill/Filaree	ERCI	ERCI6
Filago arvensis	Field Filago	FIAR	FIAR2
Fragaria spp.	Strawberry	FRAGA	FRAGA
Fragaria vesca	Woods Strawberry	FRVE	FRVE
Fragaria virginiana	Blueleaf/Broadpetal Strawberry	FRVI	FRVI
Frasera albicaulis	White-stemmed frasera	FRAL2	FRAL2
Frasera spp.	Frasera	FRASE	FRASE

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Fritillaria pudica	Yellow Bells	FRPU	FRPU2
Galium aparine	Catchweed Bedstraw/Cleavers	GAAP	GAAP2
Galium asperrimum	Rough Bedstraw	GAAS	GAAS3
Galium boreale	Northern Bedstraw	GABO	GABO2
Galium parisiense	Wall Bedstraw	GAPA2	GAPA5
Galium spp.	Bedstraw	GALIU	GALIU
Galium triflorum	Sweetscented Bedstraw	GATR	GATR3
Gayophytum diffusum	Spreading Groundsmoke	GADI	GADI2
Geranium bicknellii	Bicknell's Geranium	GEBI	GEBI2
Geranium molle	Dovefoot Geranium	GEMO	GEMO
Geranium pusillum	Small-flowered Geranium	GEPU	GEPU2
Geranium viscosissimum	Sticky Geranium	GEVI	GEVI2
Geum macrophyllum	Largeleaf Avens	GEMA	GEMA4
Geum spp.	Avens	GEUM	GEUM
Geum triflorum	Red Avens/Old Man's Whiskers	GETR	GETR
Geum triflorum campanulatum	Red Avens/Old Man's Whiskers	GETRC	GETRC
Geum triflorum triflorum	Red Avens/Old Man's Whiskers	GETRT	GETRT
Gnaphalium chilense	Cotton-batting Plant	GNCH	GNCH
Gnaphalium microcephalum	Slender Cudweed	GNMI	GNMI
Gnaphalium palustre	Lowland Cudweed	GNPA	GNPA
Gnaphalium spp.	Cudweed	GNAPH	GNAPH
Goodyera oblongifolia	Rattlesnake-plantain	GOOB	GOOB2
Grindelia nana	Low Gumweed	GRNA	GRNA
Gymnocarpium dryopteris	Oak Fern	GYDR	GYDR
Gymnosteris parvula	Small-flowered Gymnosteris	GYPA2	GYPA2
Haplopappus carthamoides	Large-flowered Goldenweed	HACA	HACA5
Heracleum lanatum	Common Cowparsnip	HELA	HELA4
Heuchera cylindrica	Roundleaf Lava Alumroot	HECY	HECY2
Heuchera grossulariifolia	Gooseberry-leaved Alumroot	HEGR	HEGR8
Heuchera grossulariifolia tenuifolia	Gooseberry-leaved Alumroot	HEGRT	HEGRT
Heuchera spp.	Alumroot	HEUCH	HEUCH
Hieracium albertinum	Western Hawkweed	HIAL2	HIAL
Hieracium albiflorum	White Hawkweed	HIAL	HIAL2
Hieracium cynoglossoides	Houndstongue Hawkweed	HICY	HICY
Hieracium scouleri	Woolly Weed	HISC	HISC2
Hieracium spp.	Hawkweed	HIERA	HIERA
Hydrophyllum capitatum	Ballhead Waterleaf/Woolly Breeches	HYCA	HYCA4
Hypericum perforatum	Klamathweed, Common St. John's Wort	HYPE	HYPE
Hypericum spp.	St. John's Wort	HYPER	HYPER
Iliamna rivularis	Streambank Globemallow	ILRI	ILRI
Lactuca serriola	Prickly Lettuce	LASE	LASE
Lactuca spp.	Lettuce	LACTU	LACTU
Lathyrus nevadensis cusickii	Cusick's Peavine	LANEC	LANEC
Lathyrus pauciflorus	Few-flowered Peavine	LAPA2	LAPA5
Lepidium densiflorum	Prairie Pepperweed	LEDE	LEDE
Lepidium ramosissimum	Branded Peppergrass	LERA	LERA2
Lepidium spp.	Pepperweed, Peppergrass	LEPID	LEPID
Ligusticum grayi	Gray's Licoriceroot/Lovage	LIGR	LIGR
Ligusticum spp.	Licoriceroot/Lovage	LIGUS	LIGUS
Linanthus harknessii	Harkness' Linanthus	LIHA	LIHA
Linaria dalmatica	Bastard Toadflax	LIDA	LIDA
Linum perenne	Blue Flax	LIPE	LIPE2
Listera caurina	Western Twayblade	LICA3	LICA10
Listera convallarioides	Broad-lipped Twayblade	LICO2	LICO5
Listera spp.	Twayblade	LISTE	LISTE

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Lithophragma bulbifera	Bulbiferous Fringecup	LIBU	LIBU2
Lithophragma parviflora	Small-flowered Fringecup	LIPA	LIPA5
Lithophragma spp.	Fringecup	LITHO	LITHO2
Lithospermum arvense	Corn Gromwell	LIAR	LIAR4
Lithospermum ruderale	Wayside Gromwell	LIRU	LIRU4
Lomatium ambiguum	Swaledesert Parsley	LOAM	LOAM
Lomatium cous	Cous Biscuitroot	LOCO2	LOCO4
Lomatium dissectum	Fernleaved Desert Parsley	LODI2	LODI
Lomatium dissectum eatonii	Fernleaved Desert Parsley	LODIE	LODIE
Lomatium leptocarpum	Slenderfruit/Bicolor Biscuitroot	LOLE	LOLE2
Lomatium macrocarpum	Big Seed Biscuitroot	LOMA	LOMA3
Lomatium spp.	Biscuitroot/Desert Parsley	LOMAT	LOMAT
Lomatium triternatum	Nineleaf Desert Parsley	LOTR	LOTR2
Lomatium triternatum platycarpum	Nineleaf Desert Parsley	LOTRP	LOTRP
Lupinus caudatus	Tailcup Lupine	LUCA	LUCA
Lupinus laxiflorus	Spurred Lupine	LULA2	LULA3
Lupinus leucophyllus tenuispicus	Woolly Lupine	LULET	LULET
Lupinus sericeus	Silky Lupine	LUSE	LUSE4
Lupinus sericeus sericeus	Silky Lupine	LUSES	LUSES2
Lupinus spp.	Lupine	LUPIN	LUPIN
Machaeranthera shastensis	Shasta Aster	MASH	MASH
Madia citriodora	Lemon Tarweed	MACI	MACI2
Madia glomerata	Cluster Tarweed	MAGL	MAGL2
Madia gracilis	Common/Slender Tarweed	MAGR	MAGR3
Madia spp.	Tarweed	MADIA	MADIA
Medicago lupulina	Black Medic	MELU	MELU
Melilotus alba	White Sweetclover	MEAL	MEAL12
Melilotus officinalis	Yellow Sweetclover	MEOF	MEOF
Melilotus spp.	Sweetclover	MELIL	MELIL
Mentzelia dispersa	Bushy Mentzelia	MEDI	MEDI
Mertensia ciliata	Broad-leaf Bluebells	MECI	MECI3
Mertensia paniculata	Tall bluebells	MEPA	MEPA
Mertensia spp.	Bluebells	MERTE	MERTE
Microseris nutans	Nodding Microseris	MINU	MINU
Microseris troximoides	False Agoseris	MITR	MITR5
Microsteris gracilis	Pink Microsteris	MIGR	MIGR
Mimulus moschatus	Musk Monkeyflower	MIMO	MIMO3
Mimulus nanus	Dwarf Monkeyflower	MINA	MINA
Mimulus spp.	Monkey-flower	MIMUL	MIMUL
Mitella spp.	Mitrewort	MITEL	MITEL
Mitella stauropetala	Side-flowered Mitrewort	MIST2	MIST3
Mitella trifida	Three-toothed Mitrewort	MITR2	MITR4
Montia perfoliata	Miner's Lettuce	MOPE	MOPE3
Myosotis micrantha	Blue Scorpion-grass	MYMI	MYMI
Myosotis scorpioides	Common Forget-me-not	MYSC	MYSC
Myosotis spp.	Forget-me-not	MYOSO	MYOSO
Navarretia intertexta	Pincushion Plant	NAIN	NAIN2
Oenothera heterantha	Longleaf Evening Primrose	OEHE	OEHE
Oenothera hookeri	Hooker Evening Primrose	OEHO	OEHO
Opuntia polycantha	Prickly Pear Cactus	OPPO	OPPO
Orthocarpus hispidus	Hairy Owl Clover	ORHI	ORHI
Orthocarpus tenuifolius	Thin-leaved Owl Clover	ORTE	ORTE2
Osmorhiza chilensis	Mountain Sweet-cicely	OSCH	OSCH
Osmorhiza occidentalis	Western Sweet-cicely	OSOC	OSOC
Pedicularis bracteosa	Bracted Lousewort	PEBR	PEBR

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Pedicularis racemosa	Leafy/Sickletop Lousewort	PERA	PERA
Penstemon deustus	Hot Rock/Scabland Penstemon	PEDE	PEDE4
Penstemon fruticosus	Shrub Penstemon	PEFR3	PEFR3
Penstemon globosus	Globe Penstemon	PEGL4	PEGL5
Penstemon rydbergii	Rydberg's Penstemon	PERY	PERY
Penstemon spp.	Penstemon	PENST	PENST
Penstemon wilcoxii	Wilcox's Penstemon	PEWI	PEWI
Perideridia bolanderi	Bolander's Yampah	PEBO	PEBO2
Perideridia gairdneri	Gairdner's Yampah	PEGA2	PEGA3
Perideridia spp.	Yampah	PERID	PERID
Phacelia hastata	Silverleaf Phacelia	PHHA	PHHA
Phacelia hastata leucophylla	Silverleaf Phacelia	PHHAL	PHHAL
Phacelia heterophylla	Varileaf Phacelia	PHHE	PHHE2
Phacelia linearis	Threadleaf Phacelia	PHLI	PHLI
Phacelia spp.	Phacelia	PHACE	PHACE
Phlox caespitosa	Tufted Phlox	PHCA2	PHCA7
Phlox colubria	Snake River Phlox	PHCO2	PHCO10
Phlox longifolia	Long-leaved Phlox	PHLO	PHLO2
Phlox pulvinata	Cushion Phlox	PHPU	PHPU5
Phlox spp.	Phlox	PHLOX	PHLOX
Phlox viscida	Sticky Phlox	PHVI3	PHVI3
Physalis longifolia	Long-leaved Ground Cherry	PHLO2	PHLO4
Physaria oregana	Oregon Twinpod	PHOR	PHOR2
Plantago elongata	Slender Plantain	PLEL	PLEL
Plantago patagonica	Indian Wheat	PLPA	PLPA2
Plectritis macrocera	Longhorn Plectritis	PLMA3	PLMA4
Polemonium pulcherrimum	Skunkleaved Polemonium/Jacob's Ladder	POPU	POPU3
Polygonum douglasii	Douglas' Knotweed	PODO	PODO4
Polygonum majus	Wiry/Palouse Knotweed	POMA2	POMA9
Polygonum polygaloides	White-margined Knotweed	POPO	POPO4
Polygonum spp.	Knotweed	POLYG	POLYG4
Polystichum lonchitis	Mountain Hollyfern	POLO2	POLO4
Potentilla glandulosa	Glandular or Sticky Cinquefoil	POGL	POGL9
Potentilla glandulosa nevadensis	Glandular or Sticky Cinquefoil	POGLN	POGLN2
Potentilla glandulosa pseudorupestris	Glandular or Sticky Cinquefoil	POGLP	POGLP2
Potentilla gracilis	Northwest/Slender Cinquefoil	POGR	POGR9
Potentilla spp.	Cinquefoil	POTEN	POTEN
Prunella vulgaris	Common Selfheal	PRVU	PRVU
Pteridium aquilinum	Bracken Fern/Brake Fern	PTAQ	PTAQ
Pyrola picta	White-vein Pyrola	PYPI	PYPI2
Pyrola secunda	Sidebells Pyrola	PYSE	PYSE
Pyrola spp.	Pyrola/Wintergreen	PYROL	PYROL
Ranunculus glaberrimus	Sagebrush Buttercup	RAGL	RAGL
Ranunculus spp.	Buttercup	RANUN	RANUN
Ranunculus uncinatus	Little Buttercup	RAUN2	RAUN
Rorippa curvisiliqua	Western Yellowcress	ROCU	ROCU
Rorippa spp.	Yellowcress	RORIP	RORIP
Rudbeckia occidentalis	Blackhead/Western Coneflower	RUOC	RUOC2
Rumex acetosella	Sheep/Red Sorrel	RUAC	RUAC3
Rumex crispus	Curly Dock	RUCR	RUCR
Rumex spp.	Dock	RUMEX	RUMEX
Sanguisorba minor	Garden Burnet	SAMI2	SAMI3
Sanguisorba occidentalis	Annual Burnet	SAOC	SAOC2
Sanguisorba spp.	Burnet	SANGU	SANGU2

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Scutellaria angustifolia	Narrowleaved Skullcap	SCAN	SCAN3
Secale cereale	Cultivated Rye	SECE	SECE
Sedum lanceolatum	Lanceleaf Stonecrop	SELA2	SELA
Sedum spp.	Stonecrop	SEDUM	SEDUM
Sedum stenopetalum	Wormleaf Stonecrop	SEST	SEST2
Selaginella spp.	Selaginella	SELAG	SELAG
Senecio canus	Woolly Groundsel	SECA	SECA2
Senecio integerrimus	Western/Woolly Groundsel	SEIN	SEIN2
Senecio serra	Butterweed Groundsel	SESE	SESE2
Senecio sphaerocephalus	Mountain Butterweed	SESP2	SESP4
Senecio spp.	Groundsel or Butterweed	SENEC	SENEC
Senecio streptanthifolius	Rocky Mountain Butterweed	SEST2	SEST3
Senecio triangularis	Arrowleaf Groundsel	SETR	SETR
Sidalcea oregana	Oregon Checkermallow	SIOR	SIOR
Silene antirrhina	Sleepy Cat	SIAN2	SIAN2
Silene menziesii	Menzies' Silene	SIME	SIME
Silene oregana	Oregon Catchfly	SIOR2	SIOR3
Silene spp.	Silene/Catchfly	SILEN	SILEN
Sisymbrium altissimum	Tumblemustard/Jim Hill Mustard	SIAL	SIAL2
Smilacina racemosa	Feather Solomonplume	SMRA	SMRA
Smilacina stellata	Western False Solomon's Seal	SMST	SMST
Solidago missouriensis	Missouri Goldenrod	SOMI	SOMI2
Solidago spp.	Goldenrod	SOLID	SOLID
Spergula arvensis	Stickwort	SPAR2	SPAR
Spergularia rubra	Red Sandspurry	SPRU	SPRU
Sphaeralcea munroana	Munro's Globemallow	SPMU	SPMU2
Stellaria jamesiana	Sticky Chickweed	STJA	STJA3
Stellaria nitens	Shining Chickweed	STNI	STNI
Stellaria spp.	Chickweed	STELL	STELL
Streptopus amplexifolius	Claspleaf Twistedstalk	STAM	STAM2
Synthyris missurica	Blue Kittentails	SYMI	SYMI
Taraxacum officinale	Common Dandelion	TAOF	TAOF
Taraxacum spp.	Dandelion	TARAX	TARAX
Thalictrum occidentale	Western Meadowrue	THOC	THOC
Tiarella trifoliata unifoliata	Coolwort Foamflower	TITRU	TITRU
Tonella floribunda	Tonella	TOFL2	TOFL
Tragopogon dubius	Yellow Salsify	TRDU	TRDU
Trautvetteria caroliniensis	False Bugbane	TRCA3	TRCA
Trifolium longipes	Longstalk Clover	TRLO	TRLO
Trifolium macrocephalum	Bighead Clover	TRMA	TRMA3
Trifolium repens	White Clover	TRRE	TRRE3
Trifolium spp.	Clover	TRIFO	TRIFO
Triticum aestivum	Cultivated Wheat	TRAE	TRAE
Urtica dioica	Stinging Nettle	URDI	URDI
Valeriana sitchensis	Sitka Valerian	VASI	VASI
Valeriana spp.	Valerian	VALER	VALER
Veratrum californicum	California Falsehellebore	VECA	VECA2
Veratrum viride	Green Falsehellebore	VEVI	VEVI
Verbascum blattaria	Moth Mullein	VEBL	VEBL
Verbascum thapsus	Flannel Mullein	VETH	VETH
Verbena bracteata	Bracted Vervain	VEBR	VEBR
Veronica americana	American Speedwell	VEAM	VEAM2
Veronica arvensis	Common Speedwell	VEAR	VEAR
Veronica peregrina	Purslane Speedwell	VEPE	VEPE2
Vicia americana	American Vetch	VIAM	VIAM

SCIENTIFIC NAME	COMMON NAME	R6 CODE	PLANTS CODE
Vicia spp.	Vetch	VICIA	VICIA
Viola adunca	Early Blue Violet	VIAD	VIAD
Viola orbiculata	Round-leaved Violet	VIOR2	VIOR
Viola purpurea	Goosefoot Violet	VIPU	VIPU4
Viola spp.	Violet	VIOLA	VIOLA
Woodsia oregana	Oregon/Western Woodsia	WOOR	WOOR
Wyethia amplexicaulis	Mule's Ears/Northern Mule's Ear	WYAM	WYAM
Xerophyllum tenax	Beargrass	XETE	XETE
Zigadenus paniculatus	Panicled Death Camas	ZIPA	ZIPA2
Zigadenus venenosus	Meadow/Deadly Death Camas	ZIVE	ZIVE
GRASSES AND GRASSLIKES			
Agropyron intermedium	Intermediate Wheatgrass	AGIN2	AGIN2
Agropyron repens	Quack Grass	AGRE	AGRE2
Agropyron spicatum	Bluebunch Wheatgrass	AGSP	AGSP
Agropyron spp.	Wheatgrass	AGROP	AGROP2
Agropyron trichophorum	Pubescent Wheatrass	AGTR2	AGTR6
Agrostis interrupta	Interrupted Bentgrass	AGIN3	AGIN4
Agrostis scabra	Winter Bentgrass/Tickle-grass	AGSC	AGSC5
Agrostis spp.	Bentgrass	AGROS	AGROS2
Alopecurus pratensis	Meadow Foxtail	ALPR	ALPR3
Bromus brizaeformis	Rattlesnake Brome	BRBR	BRBR7
Bromus carinatus	Mountain Brome	BRCA	BRCA5
Bromus commutatus	Hairy Brome/Hairy Chess	BRCO	BRCO4
Bromus inermis	Smooth Brome	BRIN	BRIN2
Bromus japonicus	Japanese Brome	BRJA	BRJA
Bromus mollis	Soft Brome	BRMO	BRMO2
Bromus spp.	Brome	BROMU	BROMU
Bromus tectorum	Cheatgrass Brome/Downy Chess	BRTE	BRTE
Bromus vulgaris	Columbia Brome	BRVU	BRVU
Calamagrostis rubescens	Pinegrass	CARU	CARU
Carex concinnoides	Northwest Sedge	CACO	CACO11
Carex geyeri	Elk Sedge	CAGE	CAGE2
Carex hoodii	Hood's Sedge	CAHO	CAHO5
Carex rossii	Ross Sedge	CARO	CARO5
Carex spp.	Sedge	CAREX	CAREX
Dactylis glomerata	Orchard Grass	DAGL	DAGL
Danthonia unispicata	Onespike Oatgrass	DAUN	DAUN
Deschampsia elongata	Slender Hairgrass	DEEL	DEEL
Elymus glaucus	Blue Wildrye	ELGL	ELGL
Festuca bromoides	Six Week's Fescue	FEBR	FEBR4
Festuca idahoensis	Idaho Fescue	FEID	FEID
Festuca microstachys	Small Fescue	FEMI	FEMI2
Festuca occidentalis	Western Fescue	FEOC	FEOC
Festuca ovina	Sheep Fescue	FEOV	FEOV
Festuca spp.	Fescue	FESTU	FESTU
Festuca viridula	Green Fescue	FEVI	FEVI
Juncus balticus	Baltic Rush	JUBA	JUBA
Juncus tenuis tenuis	Slender Rush	JUTET	JUTET
Koeleria cristata	Prairie Junegras	KOCR	KOCR
Lolium multiflorum	Italian Ryegrass/Annual Ryegrass	LOMU	LOMU
Lolium perenne	Perennial Ryegrass	LOPE2	LOPE
Lolium spp.	Ryegrass	LOLIU	LOLIU

SCIENTIFIC NAME	COMMON NAME	R6 CODE	PLANTS CODE
Luzula campestris	Field Woodrush	LUCA2	LUCA2
Melica spectabilis	Showy Oniongrass	MESP	MESP
Melica spp.	Oniongrass	MELIC	MELIC
Melica subulata	Alaska Oniongrass	MESU	MESU
Muhlenbergia mexicana	Mexican Muhly	MUME	MUME2
Phleum pratense	Common Timothy	PHPR	PHPR3
Phleum spp.	Timothy	PHLEU	PHLEU
Poa bolanderi	Bolander's Bluegrass	POBO	POBO
Poa cusickii	Cusick's Bluegrass	POCU	POCU3
Poa nervosa	Wheeler's Bluegrass	PONE	PONE2
Poa nervosa wheeleri	Wheeler's Bluegrass	PONEW	PONEW
Poa palustris	Fowl Bluegrass	POPA	POPA2
Poa pratensis	Kentucky Bluegrass	POPR	POPR
Poa sandbergii	Sandberg's Bluegrass	POSA3	POSA12
Poa spp.	Bluegrass	POA	POA
Sitanion hystrix	Bottlebrush Squirreltail	SIHY	SIHY
Sitanion hystrix hordeoides	Dwarf Squirreltail	SIHYH	SIHYH
Stipa commata	Needle-and-thread	STCO2	STCO4
Stipa lettermanii	Letterman Needlegrass	STLE	STLE4
Stipa occidentalis	Western Needlegrass	STOC	STOC2
Stipa occidentalis minor	Western Needlegrass	STOCM	STOCM
Stipa thurberiana	Thurber's Needlegrass	STTH	STTH2
Trisetum canescens	Tall Trisetum	TRCA	TRCA21
Trisetum spp.	Trisetum	TRISE	TRISE
Triticum spp.	Wheat	TRITI	TRITI

APPENDIX B. Species List (by Common Name)

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
TREES			
Douglas Fir	Pseudotsuga menziesii	PSME	PSME
Engelmann Spruce	Picea engelmannii	PIEN	PIEN
Grand Fir	Abies grandis	ABGR	ABGR
Lodgepole Pine	Pinus contorta	PICO	PICO
Ponderosa Pine	Pinus ponderosa	PIPO	PIPO
Subalpine Fir	Abies lasiocarpa	ABLA2	ABLA
Western Larch	Larix occidentalis	LAOC	LAOC
SHRUBS			
Alder	Alnus spp.	ALNUS	ALNUS
American Twinflower	Linnaea borealis	LIBO2	LIBO3
Antelope Bitterbrush	Purshia tridentata	PUTR	PUTR2
Baldhip Rose	Rosa gymnocarpa	ROGY	ROGY
Bearberry	Arctostaphylos uva-ursi	ARUV	ARUV
Bearberry Honeysuckle/Black Twinberry	Lonicera involucrata	LOIN	LOINS
Bebb Willow	Salix bebbiana	SABE	SABE2
Big Huckleberry	Vaccinium membranaceum	VAME	VAME
Big Sagebrush	Artemisia tridentata	ARTR	ARTR2
Birch/Shiny Leaf Spiraea	Spiraea betulifolia	SPBE	SPBE2
Black Elderberry	Sambucus racemosa	SARA	SARA2
Blueberry Elder	Sambucus cerulea	SACE	SACE3
Booth Willow	Salix boothii	SABO2	SABO2
Bush/Shrubby Cinquefoil	Potentilla fruitcosa	POFR	POFR4
Cascade Mountain Ash	Sorbus scopulina	SOSC2	SOSC2
Ceanothus	Ceanothus spp.	CEANO	CEANO
Common Prince's Pine	Chimaphila umbellata	CHUM	CHUM
Common Snowberry	Symphoricarpos albus	SYAL	SYAL
Creambush Oceanspray	Holodiscus discolor	HODI	HODI
Curlleaf Mountain Mahogany	Cercocarpus ledifolius	CELE	CELE3
Currant or Gooseberry	Ribes spp.	RIBES	RIBES
Elderberry	Sambucus spp.	SAMBU	SAMBU
Fool's Huckleberry	Menziesia ferruginea	MEFE	MEFE
Gray Horsebrush	Tetradymia canescens	TECA	TECA2
Gray Rabbitbrush	Chrysothamnus nauseosus	CHNA	CHNA2
Green Rabbitbrush	Chrysothamnus viscidiflorus	CHVI	CHVI8
Grouse Huckleberry/Whortleberry	Vaccinium scoparium	VASC	VASC
Lewis Mockorange/Syringa	Philadelphus lewisii	PHLE2	PHLE4
Little Prince's Pine/Pipissewa	Chimaphila menziesii	CHME	CHME
Low Oregongrape	Berberis repens	BERE	BERE
Mallow Ninebark	Physocarpus malvaceus	PHMA	PHMA5
Mountain Big Sagebrush	Artemisia tridentata vaseyana	ARTRV	ARTRV
Mountain Snowberry	Symphoricarpos oreophilus	SYOR	SYOR2
Oregon Boxwood	Pachistima myrsinites	PAMY	PAMY
Oregongrape	Berberis spp	BERBE	BERBE
Pinemat Manzanita	Arctostaphylos nevadensis	ARNE	ARNE
Poison Ivy, Poison Oak	Rhus radicans	RHRA	RHRA6
Prickly Currant/Swamp Gooseberry	Ribes lacustre	RILA	RILA
Red Raspberry	Rubus idaeus	RUID	RUID
Redstem Ceanothus	Ceanothus sanguineus	CESA	CESA
Rocky Mountain Maple	Acer glabrum	ACGL	ACGL

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Rose	Roas spp.	ROSA	ROSA5
Scouler Willow	Salix scouleriana	SASC	SASC
Sitka Alder	Alnus sinuata	ALSI	ALSI3
Smooth Sumac	Rhus glabra	RHGL	RHGL
Snowberry	Symphoricarpos spp.	SYMPH	SYMPH
Snowbrush Ceanothus/Buckbrush	Ceanothus velutinus	CEVE	CEVE
Soapberry/Canada Buffaloberry	Shepherdia canadensis	SHCA	SHCA
Sticky Currant	Ribes viscosissimum	RIVI	RIVI3
Utah Honeysuckle	Lonicera utahensis	LOUT2	LOUT2
Wax or Squaw Currant	Ribes cereum	RICE	RICE
Western Serviceberry	Amelanchier alnifolia	AMAL	AMAL2
Western Thimbleberry	Rubus parviflorus	RUPA	RUPA
Willow	Salix spp.	SALIX	SALIX
Wood's Rose	Rosa woodsii	ROWO	ROWO
FORBS			
Agoseris	Agoseris spp.	AGOSE	AGOSE
Alpine Willow-weed	Epilobium alpinum	EPAL	EPAL
Alumroot	Heuchera spp.	HEUCH	HEUCH
American Speedwell	Veronica americana	VEAM	VEAM2
American Vetch	Vicia americana	VIAM	VIAM
Annual Agoseris	Agoseris heterophylla	AGHE	AGHE2
Annual Burnet	Sanguisorba occidentalis	SAOC	SAOC2
Arnica	Arnica spp.	ARNIC	ARNIC
Arrowleaf Balsamroot	Balsamorhiza sagittata	BASA	BASA3
Arrowleaf Groundsel	Senecio triangularis	SETR	SETR
Aster	Aster spp.	ASTER	ASTER
Avens	Geum spp.	GEUM	GEUM
Ballhead/Capitate Sandwort	Arenaria congesta	ARCO2	ARCO5
Ballhead Waterleaf/Woolly Breeches	Hydrophyllum capitatum	HYCA	HYCA4
Bastard Toadflax	Linaria dalmatica	LIDA	LIDA
Beargrass	Xerophyllum tenax	XETE	XETE
Bedstraw	Galium spp.	GALIU	GALIU
Bicknell's Geranium	Geranium bicknellii	GEBI	GEBI2
Big Chickweed	Cerastium vulgatum	CEVU	CEVU
Big Seed Biscuitroot	Lomatium macrocarpum	LOMA	LOMA3
Bighead Clover	Trifolium macrocephalum	TRMA	TRMA3
Bigleaf Sandwort	Arenaria macrophylla	ARMA3	ARMA18
Bigloss	Anchusa spp.	ANCHU	ANCHU
Biscuitroot/Desert Parsley	Lomatium spp.	LOMAT	LOMAT
Black Medic	Medicago lupulina	MELU	MELU
Blackhead/Western Coneflower	Rudbeckia occidentalis	RUOC	RUOC2
Blepharipappus	Blepharipappus scaber	BLSC	BLSC
Bluebells	Mertensia spp.	MERTE	MERTE
Blueleaf/Broadpetal Strawberry	Fragaria virginiana	FRVI	FRVI
Blue Flax	Linum perenne	LIPE	LIPE2
Blue Kittentails	Synthyris missurica	SYMI	SYMI
Blue Scorpion-grass	Myosotis micrantha	MYMI	MYMI
Bolander's Yampah	Perideridia bolanderi	PEBO	PEBO2
Borage	Borago spp.	BORAG	BORAG
Bracken Fern/Brake Fern	Pteridium aquilinum	PTAQ	PTAQ
Bracted Lousewort	Pedicularis bracteosa	PEBR	PEBR
Bracted Vervain	Verbena bracteata	VEBR	VEBR

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Branded Peppergrass	Lepidium ramosissimum	LERA	LERA2
Bristly Cryptantha	Cryptantha interrupta	CRIN3	CRIN9
Brittle Bladderfern	Cystopteris fragilis	CYFR	CYFR2
Broad-leaf Bluebells	Mertensia ciliata	MECI	MECI3
Broad-lipped Twayblade	Listera convallarioides	LICO2	LICO5
Buckwheat	Eriogonum spp.	ERIOG	ERIOG
Bulbiferous Fringecup	Lithophragma bulbifera	LIBU	LIBU2
Bull/Common Thistle	Cirsium vulgare	CIVU	CIVU
Burnet	Sanguisorba spp.	SANGU	SANGU2
Bushy Mentzelia	Mentzelia dispersa	MEDI	MEDI
Buttercup	Ranunculus spp.	RANUN	RANUN
Butterweed Groundsel	Senecio serra	SESE	SESE2
California Falsehellebore	Veratrum californicum	VECA	VECA2
Canada Milkvetch	Astragalus canadensis	ASCA7	ASCA11
Canada Thistle	Cirsium arvense	CIAR	CIAR4
Catchweed Bedstraw/Cleavers	Galium aparine	GAAP	GAAP2
Chickweed	Cerastium spp.	CERAS	CERAS
Chickweed	Stellaria spp.	STELL	STELL
Cinquefoil	Potentilla spp.	POTEN	POTEN
Claspleaf Twistedstalk	Streptopus amplexifolius	STAM	STAM2
Clover	Trifolium spp.	TRIFO	TRIFO
Cluster Tarweed	Madia glomerata	MAGL	MAGL2
Columbia Monkshood	Aconitum columbianum	ACCO	ACCO4
Collomia	Collomia spp.	COLLO	COLLO
Common Camas	Camassia quamash	CAQU	CAQU2
Common Clarkia	Clarkia rhomboidea	CLRH	CLRH
Common Cowparsnip	Heracleum lanatum	HELA	HELA4
Common Cryptantha	Cryptantha intermedia	CRIN2	CRIN8
Common Dandelion	Taraxacum officinale	TAOF	TAOF
Common Eriophyllum/Woolly Sunflower	Eriophyllum lanatum	ERLA	ERLA6
Common Forget-me-not	Myosotis scorpioides	MYSC	MYSC
Common Houndstongue	Cynoglossum officinale	CYOF	CYOF
Common Pearly-everlasting	Anaphalis margaritacea	ANMA	ANMA
Common Selfheal	Prunella vulgaris	PRVU	PRVU
Common/Slender Tarweed	Madia gracilis	MAGR	MAGR3
Common Speedwell	Veronica arvensis	VEAR	VEAR
Common Willow-weed	Epilobium glandulosum	EPGL2	EPGL4
Common Yarrow	Achillea millefolium	ACMI	ACMI2
Coolwort Foamflower	Tiarella trifoliata unifoliata	TITRU	TITRU
Corn Gromwell	Lithospermum arvense	LIAR	LIAR4
Cotton-batting Plant	Gnaphalium chilense	GNCH	GNCH
Cous Biscuitroot	Lomatium cous	LOCO2	LOCO4
Cudweed	Gnaphalium spp.	GNAPH	GNAPH
Cultivated Rye	Secale cereale	SECE	SECE
Cultivated Wheat	Triticum aestivum	TRAE	TRAE
Curly Dock	Rumex crispus	RUCR	RUCR
Cushion Phlox	Phlox pulvinata	PHPU	PHPU5
Cusick's Buckwheat	Eriogonum cusickii	ERCU	ERCU3
Cusick's Milkvetch	Astragalus cusickii	ASCU4	ASCU5
Cusick's Peavine	Lathyrus nevadensis cusickii	LANEC	LANEC
Daisy or Fleabane	Erigeron spp.	ERIGE	ERIGE2
Dandelion	Taraxacum spp.	TARAX	TARAX
Deerhorn/Pink Fairies	Clarkia pulchella	CLPU	CLPU
Dock	Rumex spp.	RUMEX	RUMEX
Douglas' Brodiaea	Brodiaea douglasii	BRDO	BRDO
Douglas' Knotweed	Polygonum douglasii	PODO	PODO4

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Dovefoot Geranium	Geranium molle	GEMO	GEMO
Dragonhead	Dracocephalum parviflorum	DRPA	DRPA2
Dwarf Monkeyflower	Mimulus nanus	MINA	MINA
Dwarf Yellow Fleabane	Erigeron chrysopsidis	ERCH	ERCH4
Early Blue Violet	Viola adunca	VIAD	VIAD
Elegant Aster	Aster perelegans	ASPE	ASPE3
Elegant Mariposa	Calochortus elegans	CAEL	CAEL
Enchanter's Nightshade	Circaea alpina	CIAL	CIAL
False Agoseris	Microseris troximoides	MITR	MITR5
False Bugbane	Trautvetteria caroliniensis	TRCA3	TRCA
Feather Solomonplume	Smilacina racemosa	SMRA	SMRA
Fernleaved Desert Parsley	Lomatium dissectum	LODI2	LODI
Fernleaved Desert Parsley	Lomatium dissectum eatonii	LODIE	LODIE
Few-flowered Peavine	Lathyrus pauciflorus	LAPA2	LAPA5
Fiddleneck	Amsinckia spp.	AMSIN	AMSIN
Field Chickweed	Cerastium arvense	CEAR	CEAR4
Field Filago	Filago arvensis	FIAR	FIAR2
Fireweed	Epilobium angustifolium	EPAN	EPAN2
Flannel Mullein	Verbascum thapsus	VETH	VETH
Forget-me-not	Myosotis spp.	MYOSO	MYOSO
Frasera	Frasera spp.	FRASE	FRASE
Fremont's Lamb's Quarters	Chenopodium fremontii	CHFR	CHFR3
Fringecup	Lithophragma spp.	LITHO	LITHO2
Gairdner's Yampah	Perideridia gairdneri	PEGA2	PEGA3
Garden Burnet	Sanguisorba minor	SAMI2	SAMI3
Glandular or Sticky Cinquefoil	Potentilla glandulosa	POGL	POGL9
Glandular or Sticky Cinquefoil	Potentilla glandulosa nevadensis	POGLN	POGLN2
Glandular or Sticky Cinquefoil	Potentilla glandulosa pseudorupestris	POGLP	POGLP2
Globe Penstemon	Penstemon globosus	PEGL4	PEGL5
Golden Buckwheat	Eriogonum flavum	ERFL	ERFL4
Goldenrod	Solidago spp.	SOLID	SOLID
Gooseberry-leaved Alumroot	Heuchera grossulariifolia	HEGR	HEGR8
Gooseberry-leaved Alumroot	Heuchera grossulariifolia tenuifolia	HEGRT	HEGRT
Goosefoot Violet	Viola purpurea	VIPU	VIPU4
Gray's Licoriceroot/Lovage	Ligusticum grayi	LIGR	LIGR
Green Falsehellebore	Veratrum viride	VEVI	VEVI
Groundsel or Butterweed	Senecio spp.	SENEC	SENEC
Hairy Golden Aster	Chrysopsis villosa	CHVI2	CHVI10
Hairy Milkvetch	Astragalus inflexus	ASIN2	ASIN5
Hairy Owl Clover	Orthocarpus hispidus	ORHI	ORHI
Hairy Rockcress	Arabis hirsuta	ARHI	ARHI
Hairy Rockcress	Arabis hirsuta glabrata	ARHIG	ARHIG
Harkness' Linanthus	Linanthus harknessii	LIHA	LIHA
Harsh Paintbrush	Castilleja hispida	CAHI2	CAHI9
Hawksbeard	Crepis spp.	CREPI	CREPI
Hawkweed	Hieracium spp.	HIERA	HIERA
Heartleaf Arnica	Arnica cordifolia	ARCO	ARCO9
Holboell's Rockcress	Arabis holboellii	ARHO	ARHO2
Hooker Evening Primrose	Oenothera hookeri	OEHO	OEHO
Horseweed	Conyza canadensis	COCA2	COCA5
Horseweed	Conyza canadensis glabrata	COCAG	COCAG
Horseweed	Conyza spp.	CONYZ	CONYZ
Hot Rock/Scabland Penstemon	Penstemon deustus	PEDE	PEDE4
Houndstongue Hawkweed	Hieracium cynoglossoides	HICY	HICY
Indian Wheat	Plantago patagonica	PLPA	PLPA2
Klamathweed, Common St. John's Wort	Hypericum perforatum	HYPE	HYPE

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Knotweed	Polygonum spp.	POLYG	POLYG4
Lanceleaf Stonecrop	Sedum lanceolatum	SELA2	SELA
Large-flower Agoseris	Agoseris grandiflora	AGGR	AGGR
Large-flowered Collinsia	Collinsia grandiflora	COGR	COGR2
Large-flowered Collomia	Collomia grandiflora	COGR2	COGR4
Large-flowered Goldenweed	Haplopappus carthamoides	HACA	HACA5
Largeleaf Avens	Geum macrophyllum	GEMA	GEMA4
Larkspur	Delphinium spp.	DELPH	DELPH
Leafy/Sickletop Lousewort	Pedicularis racemosa	PERA	PERA
Lemon Tarweed	Madia citriodora	MACI	MACI2
Lettuce	Lactuca spp.	LACTU	LACTU
Licoriceroot/Lovage	Ligusticum spp.	LIGUS	LIGUS
Little Buttercup	Ranunculus uncinatus	RAUN2	RAUN
Little Larkspur	Delphinium bicolor	DEBI	DEBI
Longhorn Plectritis	Plectritis macrocera	PLMA3	PLMA4
Longleaf Evening Primrose	Oenothera heterantha	OEHE	OEHE
Long-leaved Ground Cherry	Physalis longifolia	PHLO2	PHLO4
Long-leaved Phlox	Phlox longifolia	PHLO	PHLO2
Long-leaved/Tapertip Hawksbeard	Crepis acuminata	CRAC	CRAC2
Longstalk Clover	Trifolium longipes	TRLO	TRLO
Low Gumweed	Grindelia nana	GRNA	GRNA
Low Pussytoes	Antennaria dimorpha	ANDI	ANDI2
Lowland Cudweed	Gnaphalium palustre	GNPA	GNPA
Lupine	Lupinus spp.	LUPIN	LUPIN
Mariposa or Sego Lily	Calochortus spp.	CALOC	CALOC
Meadow/Deadly Death Camas	Zigadenus venenosus	ZIVE	ZIVE
Menzies' Silene	Silene menziesii	SIME	SIME
Milkvetch	Astragalus spp.	ASTRA	ASTRA
Miner's Lettuce	Montia perfoliata	MOPE	MOPE3
Missouri Goldenrod	Solidago missouriensis	SOMI	SOMI2
Mitrewort	Mitella spp.	MITEL	MITEL
Monkey-flower	Mimulus spp.	MIMUL	MIMUL
Moth Mullein	Verbascum blattaria	VEBL	VEBL
Mountain Arnica	Arnica latifolia	ARLA	ARLA8
Mountain Arnica	Arnica latifolia latifolia	ARLAL	UNASSGND
Mountain Butterweed	Senecio sphaerocephalus	SESP2	SESP4
Mountain Hollyfern	Polystichum lonchitis	POLO2	POLO4
Mountain Sweet-cicely	Osmorhiza chilensis	OSCH	OSCH
Mountain Tansymustard	Descurainia richardsonii	DERI	DERI2
Mountain Tansymustard	Descurainia richardsonii sonnei	DERIS	DERIS
Mule's Ears/Northern Mule's Ear	Wyethia amplexicaulis	WYAM	WYAM
Munro's Globemallow	Sphaeralcea munroana	SPMU	SPMU2
Musk Monkeyflower	Mimulus moschatus	MIMO	MIMO3
Narrow-leaf Collomia	Collomia linearis	COLI2	COLI2
Narrow-leaf Pussytoes	Antennaria stenophylla	ANST	ANST2
Narrowleaved Skullcap	Scutellaria angustifolia	SCAN	SCAN3
Nettleleaf Horsemint	Agastache urticifolia	AGUR	AGUR
Nineleaf Desert Parsley	Lomatium triternatum	LOTR	LOTR2
Nineleaf Desert Parsley	Lomatium triternatum platycarpum	LOTRP	LOTRP
Nodding Microseris	Microseris nutans	MINU	MINU
Northern Buckwheat	Eriogonum compositum	ERCO5	ERCO12
Northern Bedstraw	Galium boreale	GABO	GABO2
Northwest/Slender Cinquefoil	Potentilla gracilis	POGR	POGR9
Oak Fern	Gymnocarpium dryopteris	GYDR	GYDR
Onion	Allium spp.	ALLIU	ALLIU

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Oregon Catchfly	Silene oregana	SIOR2	SIOR3
Oregon Checkermallow	Sidalcea oregana	SIOR	SIOR
Oregon Twinpod	Physaria oregana	PHOR	PHOR2
Oregon/Western Woodsia	Woodsia oregana	WOOR	WOOR
Paintbrush	Castilleja spp.	CASTI	CASTI2
Pale Agoseris	Agoseris glauca	AGGL	AGGL
Pale Alyssum	Alyssum alyssoides	ALAL	ALAL3
Panicled Death Camas	Zigadenus paniculatus	ZIPA	ZIPA2
Penstemon	Penstemon spp.	PENST	PENST
Pepperweed, Peppergrass	Lepidium spp.	LEPID	LEPID
Phacelia	Phacelia spp.	PHACE	PHACE
Phlox	Phlox spp.	PHLOX	PHLOX
Pigweed	Amaranthus spp.	AMARA	AMARA
Pincushion Plant	Navarretia intertexta	NAIN	NAIN2
Pinewoods Cryptantha	Cryptantha simulans	CRSI	CRSI2
Pink Microsteris	Microsteris gracilis	MIGR	MIGR
Pinnate Tansymustard	Descurainia pinnata	DEPI	DEPI
Prairie Pepperweed	Lepidium densiflorum	LEDE	LEDE
Prickly Lettuce	Lactuca serriola	LASE	LASE
Prickly Pear Cactus	Opuntia polycantha	OPPO	OPPO
Purslane Speedwell	Veronica peregrina	VEPE	VEPE2
Pussytoes	Antennaria spp.	ANTEN	ANTEN
Pyrola/Wintergreen	Pyrola spp.	PYROL	PYROL
Queen's Cup Beadlily	Clintonia uniflora	CLUN	CLUN2
Rattlesnake-plantain	Goodyera oblongifolia	GOOB	GOOB2
Rayless Daisy	Erigeron inornatus	ERIN2	ERIN2
Red Avens/Old Man's Whiskers	Geum triflorum	GETR	GETR
Red Avens/Old Man's Whiskers	Geum triflorum campanulatum	GETRC	GETRC
Red Avens/Old Man's Whiskers	Geum triflorum triflorum	GETRT	GETRT
Red Kittentail/Red Besseya	Besseya rubra	BERU	BERU
Red Sandspurry	Spergularia rubra	SPRU	SPRU
Rigid Fiddleneck	Amsinckia retrorsa	AMRE2	AMRE2
Rockcress	Arabis spp.	ARABI	ARABI2
Rocky Mountain Butterweed	Senecio streptanthifolius	SEST2	SEST3
Rosy Pussytoes	Antennaria microphylla	ANMI2	ANMI3
Rough Bedstraw	Galium asperrimum	GAAS	GAAS3
Roundleaf Lava Alumroot	Heuchera cylindrica	HECY	HECY2
Round-leaved Violet	Viola orbiculata	VIOR2	VIOR
Ryberg's Penstemon	Penstemon rydbergii	PERY	PERY
Sagebrush Buttercup	Ranunculus glaberrimus	RAGL	RAGL
Sagebrush Mariposa	Calochortus macrocarpus	CAMA	CAMA5
Sandwort	Arenaria spp.	ARENA	ARENA
Scarlet Paintbrush	Castilleja miniata	CAMI2	CAMI12
Selaginella	Selaginella spp.	SELAG	SELAG
Serrated Balsamroot	Balsamorhiza serrata	BASE	BASE2
Shaggy Fleabane	Erigeron pumilus	ERPU	ERPU2
Shasta Aster	Machaeranthera shastensis	MASH	MASH
Sheep/Red Sorrel	Rumex acetosella	RUAC	RUAC3
Sheldon's Milkvetch	Astragalus reventus sheldonii	ASRES	ASRES
Shepherd's Purse	Capsella bursa-pastoris	CABU	CABU2
Shining Chickweed	Stellaria nitens	STNI	STNI
Shooting-star	Dodecatheon spp.	DODEC	DODEC
Showy Aster	Aster conspicuus	ASCO	ASCO3
Showy Fleabane	Erigeron speciosus	ERSP	ERSP4
Shrub Penstemon	Penstemon fruticosus	PEFR3	PEFR3
Sidebells Pyrola	Pyrola secunda	PYSE	PYSE

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Side-flowered Mitrewort	Mitella stauropetala	MIST2	MIST3
Silene/Catchfly	Silene spp.	SILEN	SILEN
Silky Lupine	Lupinus sericeus	LUSE	LUSE4
Silky Lupine	Lupinus sericeus sericeus	LUSES	LUSES2
Silverleaf Phacelia	Phacelia hastata	PHHA	PHHA
Silverleaf Phacelia	Phacelia hastata leucophylla	PHHAL	PHHAL
Sitka/Red Columbine	Aquilegia formosa	AQFO	AQFO
Sitka Valerian	Valeriana sitchensis	VASI	VASI
Skunkleaved Polemonium/Jacob's Ladder	Polemonium pulcherrimum	POPU	POPU3
Sleepy Cat	Silene antirrhina	SIAN2	SIAN2
Slender Cryptantha	Cryptantha affinis	CRAF	CRAF
Slender Cudweed	Gnaphalium microcephalum	GNMI	GNMI
Slender Hawksbeard	Crepis atrabarba	CRAT	CRAT
Slender Plantain	Plantago elongata	PLEL	PLEL
Slender Pussytoes	Antennaria racemosa	ANRA	ANRA
Slenderfruit/Bicolor Biscuitroot	Lomatium leptocarpum	LOLE	LOLE2
Slim/Dwarf Larkspur	Delphinium depauperatum	DEDE	DEDE2
Small-fld Willow-weed	Epilobium minutum	EPMI	EPMI
Small-flowered Blue-eyed Mary	Collinsia parviflora	COPA	COPA3
Small-flowered Fringecup	Lithophragma parviflora	LIPA	LIPA5
Small-flowered Geranium	Geranium pusillum	GEPU	GEPU2
Small-flowered Gymnosteris	Gymnosteris parvula	GYPA2	GYPA2
Smooth Willow-weed	Epilobium glaberrimum	EPGL	EPGL
Smooth Willow-weed	Epilobium glaberrimum fastigiatum	EPGLF	EPGLF2
Snake River Phlox	Phlox colubria	PHCO2	PHCO10
Spotted Coral Root	Corallorhiza maculata	COMA3	COMA4
Spreading Dogbane	Apocynum androsaemifolium	APAN	APAN2
Spreading Dogbane	Apocynum androsaemifolium pumilum	APANP	APANP
Spreading Groundsmoke	Gayophytum diffusum	GADI	GADI2
Spring Whitlow-grass	Draba verna	DRVE2	DRVE2
Spurred Lupine	Lupinus laxiflorus	LULA2	LULA3
St. John's Wort	Hypericum spp.	HYPER	HYPER
Stickwort	Spergula arvensis	SPAR2	SPAR
Sticky Chickweed	Cerastium viscosum	CEVI	CEVI3
Sticky Chickweed	Stellaria jamesiana	STJA	STJA3
Sticky Geranium	Geranium viscosissimum	GEVI	GEVI2
Sticky Phlox	Phlox viscida	PHVI3	PHVI3
Stinging Nettle	Urtica dioica	URDI	URDI
Stork's Bill/Filaree	Erodium cicutarium	ERCI	ERCI6
Strawberry	Fragaria spp.	FRAGA	FRAGA
Streambank Globemallow	Iliamna rivularis	ILRI	ILRI
Stonecrop	Sedum spp.	SEDUM	SEDUM
Subalpine Daisy	Erigeron peregrinus	ERPE	ERPE3
Swaledesert Parsley	Lomatium ambiguum	LOAM	LOAM
Sweetclover	Melilotus spp.	MELIL	MELIL
Sweetscented Bedstraw	Galium triflorum	GATR	GATR3
Tailcup Lupine	Lupinus caudatus	LUCA	LUCA
Tall Annual Willow-weed	Epilobium paniculatum	EPPA	EPPA2
Tall bluebells	Mertensia paniculata	MEPA	MEPA
Tall Pussytoes	Antennaria anaphaloides	ANAN	ANAN2
Tapertip Onion	Allium acuminatum	ALAC	ALAC4
Tarweed	Madia spp.	MADIA	MADIA
Thin-leaved Owl Clover	Orthocarpus tenuifolius	ORTE	ORTE2
Thistle	Cirsium spp.	CIRSI	CIRSI

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Threadleaf Fleabane	Erigeron filifolius	ERFI	ERFI2
Threadleaf Phacelia	Phacelia linearis	PHLI	PHLI
Three-toothed Mitrewort	Mitella trifida	MITR2	MITR4
Thyme-leaf Sandwort	Arenaria serpyllifolia	ARSE	ARSE2
Tolmie's Onion	Allium tolmiei	ALTO	ALTO
Tolmie's Onion	Allium tolmiei platyphyllum	ALTOP	ALTOP2
Tonella	Tonella floribunda	TOFL2	TOFL
Torrey's Cryptantha	Cryptantha torreyana	CRTO	CRTO4
Trail/Pathfinder Plant	Adenocaulon bicolor	ADBI	ADBI
Tufted Phlox	Phlox caespitosa	PHCA2	PHCA7
Tumblemustard/Jim Hill Mustard	Sisymbrium altissimum	SIAL	SIAL2
Turpentine Cymopterus	Cymopterus terebinthinus foeniculaceus	CYTEF	CYTEF
Twayblade	Listera spp.	LISTE	LISTE
Twin Arnica	Arnica sororia	ARSO	ARSO2
Upland Larkspur	Delphinium nuttallianum	DENU3	DENU2
Valerian	Valeriana spp.	VALER	VALER
Varileaf Phacelia	Phacelia heterophylla	PHHE	PHHE2
Vetch	Vicia spp.	VICIA	VICIA
Violet	Viola spp.	VIOLA	VIOLA
Wall Bedstraw	Galium parisiense	GAPA2	GAPA5
Wartberry Fairybells	Disporum trachycarpum	DITR	DITR2
Watson's Willow-weed	Epilobium watsonii	EPWA	EPWA3
Watson's Willow-weed	Epilobium watsonii occidentale	EPWAO	EPWAO2
Wavy-leaved Paintbrush	Castilleja applegatei	CAAP2	CAAP4
Wayside Gromwell	Lithospermum ruderale	LIRU	LIRU4
Weak-stemmed Cryptantha	Cryptantha flaccida	CRFL	CRFL4
Western False Solomon's Seal	Smilacina stellata	SMST	SMST
Western Goldthread	Coptis occidentalis	COOC2	COOC
Western Hawkweed	Hieracium albertinum	HIAL2	HIAL
Western Houndstongue	Cynoglossum occidentale	CYOC	CYOC
Western Meadowrue	Thalictrum occidentale	THOC	THOC
Western mugwort	Artemisia ludoviciana	ARLU	ARLU
Western Sweet-cicely	Osmorhiza occidentalis	OSOC	OSOC
Western Twayblade	Listera caurina	LICA3	LICA10
Western/Woolly Groundsel	Senecio integerrimus	SEIN	SEIN2
Western Yellowcress	Rorippa curvisiliqua	ROCU	ROCU
White Clover	Trifolium repens	TRRE	TRRE3
White Hawkweed	Hieracium albiflorum	HIAL	HIAL2
White-margined Knotweed	Polygonum polygaloides	POPO	POPO4
White-stemmed frasera	Frasera albicaulis	FRAL2	FRAL2
White Sweetclover	Melilotus alba	MEAL	MEAL12
White-vein Pyrola	Pyrola picta	PYPI	PYPI2
Wilcox's Penstemon	Penstemon wilcoxii	PEWI	PEWI
Wild Oats	Avena fatua	AVFA	AVFA
Wild Red Baneberry	Actaea rubra	ACRU	ACRU2
Willow-weed	Epilobium spp.	EPILO	EPILO
Windflower	Anemone piperi	ANPI	ANPI
Wiry/Palouse Knotweed	Polygonum majus	POMA2	POMA9
Woodrush Pussytoes	Antennaria luzuloides	ANLU	ANLU2
Woods Strawberry	Fragaria vesca	FRVE	FRVE
Woodybranch Rockcress	Arabis lignifera	ARLI	ARLI
Woolly Balsamroot	Balsamorhiza incana	BAIN	BAIN
Woolly Groundsel	Senecio canus	SECA	SECA2
Woolly Lupine	Lupinus leucophyllus tenuispicus	LULET	LULET
Woolly Weed	Hieracium scouleri	HISC	HISC2
Wormleaf Stonecrop	Sedum stenopetalum	SEST	SEST2

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Wyeth's Creamy Buckwheat	Eriogonum heracleoides	ERHE	ERHE2
Yampah	Perideridia spp.	PERID	PERID
Yellow Bells	Fritillaria pudica	FRPU	FRPU2
Yellowcress	Rorippa spp.	RORIP	RORIP
Yellow Salsify	Tragopogon dubius	TRDU	TRDU
Yellow Sweetclover	Melilotus officinalis	MEOF	MEOF
GRASSES AND GRASSLIKES			
Alaska Oniongrass	Melica subulata	MESU	MESU
Baltic Rush	Juncus balticus	JUBA	JUBA
Bentgrass	Agrostis spp.	AGROS	AGROS2
Blue Wildrye	Elymus glaucus	ELGL	ELGL
Bluebunch Wheatgrass	Agropyron spicatum	AGSP	AGSP
Bluegrass	Poa spp.	POA	POA
Bolander's Bluegrass	Poa bolanderi	POBO	POBO
Bottlebrush Squirreltail	Sitanion hystrix	SIHY	SIHY
Brome	Bromus spp.	BROMU	BROMU
Cheatgrass Brome/Downy Chess	Bromus tectorum	BRTE	BRTE
Columbia Brome	Bromus vulgaris	BRVU	BRVU
Common Timothy	Phleum pratense	PHPR	PHPR3
Cusick's Bluegrass	Poa cusickii	POCU	POCU3
Dwarf Squirreltail	Sitanion hystrix hordeoides	SIHYH	SIHYH
Elk Sedge	Carex geyeri	CAGE	CAGE2
Fescue	Festuca spp.	FESTU	FESTU
Field Woodrush	Luzula campestris	LUCA2	LUCA2
Fowl Bluegrass	Poa palustris	POPA	POPA2
Green Fescue	Festuca viridula	FEVI	FEVI
Hairy Brome/Hairy Chess	Bromus commutatus	BRCO	BRCO4
Hood's Sedge	Carex hoodii	CAHO	CAHO5
Idaho Fescue	Festuca idahoensis	FEID	FEID
Intermediate Wheatgrass	Agropyron intermedium	AGIN2	AGIN2
Interrupted Bentgrass	Agrostis interrupta	AGIN3	AGIN4
Italian Ryegrass/Annual Ryegrass	Lolium multiflorum	LOMU	LOMU
Japanese Brome	Bromus japonicus	BRJA	BRJA
Kentucky Bluegrass	Poa pratensis	POPR	POPR
Letterman Needlegrass	Stipa lettermanii	STLE	STLE4
Meadow Foxtail	Alopecurus pratensis	ALPR	ALPR3
Mexican Muhly	Muhlenbergia mexicana	MUME	MUME2
Mountain Brome	Bromus carinatus	BRCA	BRCA5
Needle-and-thread	Stipa commata	STCO2	STCO4
Northwest Sedge	Carex concinnoides	CACO	CACO11
Onespike Oatgrass	Danthonia unispicata	DAUN	DAUN
Oniongrass	Melica spp.	MELIC	MELIC
Orchard Grass	Dactylis glomerata	DAGL	DAGL
Perennial Ryegrass	Lolium perenne	LOPE2	LOPE
Pinegrass	Calamagrostis rubescens	CARU	CARU
Prairie Junegras	Koeleria cristata	KOCR	KOCR
Pubescent Wheatrass	Agropyron trichophorum	AGTR2	AGTR6
Quack Grass	Agropyron repens	AGRE	AGRE2
Rattlesnake Brome	Bromus brizaeformis	BRBR	BRBR7
Ross Sedge	Carex rossii	CARO	CARO5
Ryegrass	Lolium spp.	LOLIU	LOLIU
Sandberg's Bluegrass	Poa sandbergii	POSA3	POSA12
Sedge	Carex spp.	CAREX	CAREX

COMMON NAME	SCIENTIFIC NAME	R6 CODE	PLANTS CODE
Sheep Fescue	Festuca ovina	FEOV	FEOV
Showy Oniongrass	Melica spectabilis	MESP	MESP
Six Week's Fescue	Festuca bromoides	FEBR	FEBR4
Slender Hairgrass	Deschampsia elongata	DEEL	DEEL
Slender Rush	Juncus tenuis tenuis	JUTET	JUTET
Small Fescue	Festuca microstachys	FEMI	FEMI2
Smooth Brome	Bromus inermis	BRIN	BRIN2
Soft Brome	Bromus mollis	BRMO	BRMO2
Tall Trisetum	Trisetum canescens	TRCA	TRCA21
Thurber's Needlegrass	Stipa thurberiana	STTH	STTH2
Timothy	Phleum spp.	PHLEU	PHLEU
Trisetum	Trisetum spp.	TRISE	TRISE
Western Fescue	Festuca occidentalis	FEOC	FEOC
Western Needlegrass	Stipa occidentalis	STOC	STOC2
Western Needlegrass	Stipa occidentalis minor	STOCM	STOCM
Wheat	Triticum spp.	TRITI	TRITI
Wheatgrass	Agropyron spp.	AGROP	AGROP2
Wheeler's Bluegrass	Poa nervosa	PONE	PONE2
Wheeler's Bluegrass	Poa nervosa wheeleri	PONEW	PONEW
Winter Bentgrass/Tickle-grass	Agrostis scabra	AGSC	AGSC5

Appendix C. Wildfires Used in the Study
(These fires burned during the period 1986 - 1994)

Wallowa-Whitman NF

Wallowa Valley RD

1986	Kuhn Ridge
	Gould Gulch
	Fire Ridge
	Joseph - Starvation
	Burn Spring
1989	Canal
1994	Thomason Complex

Hells Canyon NRA

1985	Pleasant Valley Exclosure
1986	Sheep Divide (Middle Point)
1988	Teepee Butte
1989	Summit
1994	Twin Lakes
	Rapid River (in Idaho)

Burnt Powder Fire Zone (Baker, Pine, and Unity RD)

1986	Blue Canyon
	Clear
	Cornet
	Eagle
	Sunflower/Cottonwood
	Huckleberry
	Dark Canyon
1989	Dooley
1994	Twin Lakes

Umatilla NF

North Fork John Day RD

1986	Crane Creek
1987	Ryder Creek

Malheur NF

Bear Valley RD

1986	Scalp

Burns RD

1994	Jordan Springs

Prairie City RD

1986	Deardorff
1990	Snowshoe

Appendix D. Capsulized Characteristics of the Fires Used in the Study

Wallowa-Whitman National Forest

Hells Canyon NRA

Sheep Divide (1986) (Middle Point)
Burned August 10
Acreage = 2265
Intensity: low = 68%; medium = 11%; high = 21%
Vegetation = 40% ponderosa pine - Douglas-fir
10% grand fir
50% Idaho fescue and bluebunch wheatgrass

Teepee Butte (1988)
Burned August 25 to September 15
Acreage = 54,300
Intensity: low = 76%; medium = 7%; high = 17%
Vegetation = 19% grand fir
18% Douglas-fir
62% bunchgrass/rock
1% other

Summit (1989)
Burned July 26 to August 14
Acreage = 8000
Intensity: low = 23%; medium = 74%; high = 3%
Vegetation = 95% subalpine fir/grouse huckleberry
5% wet and dry meadows

Twin Lakes (1994)
Started August 28th
Acreage = 19,782
Intensity: low = 67%; medium = 15%; high = 18%
Vegetation = 86% forest
14% non-forest

Rapid River (1994)
Started August 3rd
Acreage = 7868
Intensity: low = 7068; medium = 400; high = 400
Vegetation = 80% forest
20% non-forest

Wallowa Valley RD

Joseph-Starvation Complex (1986)
Started August 10th
Acreage = 40,163

Kuhn Ridge (1986)
Started August 10th
Acreage = 2,200

Burn Spring (1986)
Started August 11th
Acreage = 10

Gould Gulch (1986)
Started August 10th
Acreage = 1,040

Fire Ridge (1986)
Started August 10th
Acreage = 960

Canal (1989)
Burned July 26 to August 14
Acreage = 21,898
Intensity: low = 44%; medium = 13%; high = 43%
Vegetation = 38% subalpine fir
38% grand fir
2% Douglas-fir - ponderosa pine
22% open

Thomason Complex (1994)
Started August 28th
Acreage = 7720
Intensity: low = 95%; medium = 0%; high = 5%
Vegetation = 42% forest
58% non-forest

Burnt River Fire Zone

Blue Canyon (1986)
Burned August 2 to August 7
Acreage = 169
Intensity: low = 55%; medium = 15%; high = 30%
Vegetation = 60% ponderosa pine/bunchgrass
40% ponderosa pine/rabbitbrush

Clear (1986)
Burned August 4 to August 11
Acreage = 6400
Intensity: low = 58%; medium = 6%; high = 36%
Vegetation = 15% subalpine fir/grouse huckleberry
10% subalpine fir-whitebark pine/elk sedge
65% lodgepole pine
10% mountain big sage and dry meadows

Cornet (1986)
Burned August 2 to August 7
Acreage = 1730
Intensity: low = 25%; medium = 19%; high = 56%
Vegetation = 54% ponderosa pine - Douglas-fir/elk sedge
23% ponderosa pine/bluebunch wheatgrass
23% mountain big sage/bunchgrass

Dark Canyon (1986)
Burned August 2 to August 7
Acreage = 1594
Intensity: low = 24%; medium = 26%; high = 50%
Vegetation = 30% ponderosa pine/bluebunch wheatgrass
40% grand fir/pinegrass-elk sedge
20% Douglas-fir
10% ponderosa pine

Eagle (1986)
Burned August 2 to August 8
Acreage = 308
Intensity: low = 30%; medium = 30%; high = 40%
Vegetation = ponderosa pine - Douglas-fir
ponderosa pine/Idaho fescue
Sandberg's bluegrass - onespike oatgrass

Huckleberry (1986) Burned August 2 to August 9
Acreage = 8,264
Intensity: low = 18%; medium = 44%; high = 38%
Vegetation = 50% grand fir/pinegrass
30% ponderosa pine - Douglas-fir/elk sedge
20% ponderosa pine/bunchgrass

Sunflower/Cottonwood (1986) Burned August 2 to August 9
Acreage = 2906
Intensity: low = 27%; medium = 24%; high = 49%
Vegetation = 70% Douglas-fir
20% ponderosa pine-w. juniper/mtn. mahogany
10% grand fir

Dooley (1989) Burned July 26 to August 6
Acreage = 10,240
Intensity: low = 23%; medium = 22%; high = 55%
Vegetation = ponderosa pine - Douglas-fir/elk sedge
grand fir/pinegrass

Malheur National Forest

Bear Valley RD

Scalp (1986)
Acreage = 485
Intensity: low = 20%; medium = 30%; high = 50%
Vegetation = 60% Douglas-fir/grand fir
40% ponderosa pine

Burns RD

Jordan Springs (1994) Burned August 27 to September 5
Acreage = 4906
Intensity: low = 45%; medium = 35%; high = 20%
Vegetation: ponderosa pine/mountain big sage/bunchgrass
grand fir/pinegrass and elk sedge
mountain mahogany

Prairie City RD

Deardorff (1986)
Acreage = 945
Intensity: low = 85%; medium = 0%; high = 15%
Vegetation: ponderosa pine and grand fir

Snowshoe (1990)
Burned August 6 to August 21
Acreage = 12,530
Intensity: low = 14%; medium = 33%; high = 53%
Vegetation: grand fir/elk sedge; grand fir/pinegrass; grand fir/grouse huckleberry; grand fir/ twinflower; grand fir/ big huckleberry; subalpine fir/grouse huckleberry.

Umatilla National Forest

North Fork John Day RD

Crane Creek (1986)
Started August 11th
Acreage = 5800

Ryder Creek (1987)
Burned August 13th to December 1st
Acreage = 14,650

Appendix E. Selected Plant Responses to Fire Severities (after the first and fifth years)
(+) = increase; (-) = decrease; (0) = no change

TREES	1st Year			5th Year		
	Light	Moderate	Severe	Light	Moderate	Severe
SUBALPINE FIR SERIES						
subalpine fir	No Data	-	-	No Data	-	-
grand fir	No Data	-	-	No Data	-	-
Engelmann spruce	No Data	-	-	No Data	-	-
lodgepole pine	No Data	-	-	No Data	+	+
GRAND FIR SERIES (cool,moist)						
grand fir	-	-	-	No Data	+	0
Douglas-fir	No Data	-	-	No Data	+	+
western larch	No Data	+	-	No Data	+	+
lodgepole pine	No Data	-	-	No Data	+	+
GRAND FIR SERIES (warm,dry)						
grand fir	No Data	-	-	No Data	-	-
Douglas-fir	No Data	0	-	No Data	0	+
western larch	No Data	-	-	No Data	0	+
lodgepole pine	No Data	-	-	No Data	+	+
ponderosa pine	No Data	0	-	No Data	0	+
DOUGLAS-FIR SERIES						
Douglas-fir	0	0	-	0	0	-
ponderosa pine	0	0	-	+	0	-
PONDEROSA PINE SERIES						
ponderosa pine	+	No Data	-	+	No Data	-

SHRUBS	1st Year			5th Year		
FORESTS	**Light**	**Moderate**	**Severe**	**Light**	**Moderate**	**Severe**
SUBALPINE FIR SERIES						
fool's huckleberry	No Data	No Data	-	No Data	No Data	+
big huckleberry	No Data	-	-	No Data	+	+
grouse huckleberry	No Data	-	-	No Data	+	+
gooseberries/currents	No Data	No Data	0	No Data	+	+
Utah honeysuckle	No Data	-	0	No Data	+	+
Scouler willow	No Data	+	+	No Data	0	+
twinflower	No Data	No Data	-	No Data	No Data	-
black elderberry	No Data	+	+	No Data	No Data	+
GRAND FIR SERIES (cool,moist)						
twinflower	No Data	-	No Data	No Data	+	No Data
snowbrush ceanothus	No Data	No Data	+	No Data	+	+
creeping Oregon-grape	No Data	No Data	+	No Data	+	+
big huckleberry	No Data	-	-	No Data	+	No Data
Utah honeysuckle	0	-	-	0	-	No Data
Scouler willow	0	0	+	+	+	+
birchleaf spiraea	No Data	-	+	No Data	+	0
GRAND FIR SERIES (warm,dry)						
snowbrush ceanothus	No Data	No Data	No Data	No Data	0	+
creeping Oregon-grape	No Data	No Data	No Data	No Data	No Data	0
Scouler willow	No Data	No Data	No Data	No Data	0	0
grouse huckleberry	No Data	No Data	No Data	No Data	+	+
birchleaf spiraea	No Data	No Data	No Data	No Data	No Data	0
DOUGLAS-FIR SERIES						
ninebark	No Data	-	-	No Data	+	+
birchleaf spiraea	0	0	-	0	0	+
common snowberry	0	0	-	0	0	+
redstem ceanothus	No Data	No Data	+	No Data	No Data	+
snowbrush ceanothus	No Data	No Data	0	No Data	No Data	+
creeping Oregon-grape	-	No Data	No Data	+	No Data	No Data
mountain snowberry	-	No Data	No Data	+	No Data	No Data
PONDEROSA PINE SERIES						
common snowberry	0	No Data	-	+	No Data	+
birchleaf spiraea	0	No Data	No Data	0	No Data	No Data
creeping Oregon-grape	0	No Data	No Data	0	No Data	No Data
SHRUBLANDS						
ninebark	No Data	No Data	-	No Data	No Data	+
common snowberry	No Data	-	-	No Data	+	-
birchleaf spiraea	No Data	No Data	+	No Data	No Data	-
mountain big sagebrush	No Data	-	-	No Data	+	+
mountain mahogany	No Data	0	-	No Data	0	-
mountain snowberry	No Data	0	-	No Data	0	+
rabbitbrushes	No Data	0	-	No Data	+	+

HERBACEOUS VEGETATION	1st Year			5th Year		
	Light	Moderate	Severe	Light	Moderate	Severe
SUBALPINE FIR SERIES						
heartleaf arnica	No Data	+	+	No Data	+	+
skunk-leaved polemonium	No Data	0	-	No Data	+	+
Sitka valerian	No Data	0	-	No Data	+	-
round leaved violet	No Data	0	0	No Data	+	0
pearly everlasting	No Data	0	0	No Data	+	+
fireweeds	No Data	0	+	No Data	+	+
sidebells pyrola	No Data	-	-	No Data	-	-
GRAND FIR SERIES (cool,moist)						
pinegrass	No Data	0	+	No Data	+	0
Ross' sedge	-	+	No Data	No Data	-	No Data
elk sedge	No Data	+	0	No Data	0	+
strawberries	-	-	+	No Data	+	+
round-leaved violet	No Data	-	No Data	No Data	-	No Data
fireweeds	+	0	+	No Data	+	0
heartleaf arnica	No Data	No Data	-	No Data	No Data	-
sidebells pyrola	-	No Data	-	No Data	No Data	0
GRAND FIR SERIES (warm,dry)						
pinegrass	No Data	No Data	No Data	No Data	0	+
elk sedge	No Data	No Data	No Data	No Data	+	+
mountain brome	No Data	No Data	No Data	No Data	+	+
annual bromes	No Data	No Data	No Data	No Data	No Data	+
western fescue	No Data	No Data	No Data	No Data	+	+
western yarrow	No Data	No Data	No Data	No Data	+	+
bull thistle	No Data	No Data	No Data	No Data	+	+
fireweeds	No Data	No Data	No Data	No Data	No Data	+
strawberries	No Data	No Data	No Data	No Data	+	+
lupines	No Data	No Data	No Data	No Data	No Data	+
DOUGLAS-FIR SERIES						
pinegrass	-	-	-	+	+	+
elk sedge	0	+	-	+	0	-
western fescue	No Data	0	0	No Data	+	+
heartleaf arnica	-	-	-	+	+	0
strawberries	0	+	-	0	+	+
mitella	No Data	0	-	No Data	+	+
prickly lettuce	No Data	0	+	0	0	-
fireweeds	No Data	+	+	0	0	+
yarrow	0	0	0	+	+	+
cleavers	No Data	0	0	No Data	+	+
PONDEROSA PINE SERIES						
pinegrass	No Data	No Data	No Data	+	No Data	+
Idaho fescue	No Data	No Data	No Data	+	No Data	+
annual bromes	No Data	No Data	No Data	+	No Data	+
fireweeds	No Data	No Data	No Data	+	No Data	+
yarrow	No Data	No Data	No Data	0	No Data	+
prickly lettuce	No Data	No Data	No Data	No Data	No Data	0
lupines	No Data	No Data	No Data	0	No Data	No Data

HERBACEOUS VEGETATION, Con't.	1st Year			5th Year		
	Light	Moderate	Severe	Light	Moderate	Severe
SHRUBLANDS						
pinegrass	No Data	No Data	-	No Data	0	+
bluebunch wheatgrass	No Data	+/-	-	No Data	+	+
Idaho fescue	No Data	-	-	No Data	+	0
Kentucky bluegrass	No Data	0	No Data	No Data	0	No Data
mountain brome	No Data	+	+	No Data	0	No Data
annual bromes	No Data	+	+	No Data	+	+
western yarrow	No Data	+	+	No Data	-	-
heartleaf arnica	No Data	No Data	-	No Data	No Data	+
lupines	No Data	+	+	No Data	+/0	No Data
creamy buckwheat	No Data	-	-	No Data	No Data	No Data
tumblemustard	No Data	-	+	No Data	0	-
miner's lettuce	No Data	0	0	No Data	+	+
yellow salsify	No Data	+	0	No Data	-	No Data
goatweed	No Data	-	No Data	No Data	+	No Data
GRASSLANDS						
BLUEBUNCH WHEATGRASS SERIES						
bluebunch wheatgrass	0	+	-	+	0	-
Sandberg's bluegrass	0	+	+	0	0	-
annual bromes	+	+	-	+	-	+
western yarrow	No Data	-	-	No Data	0	-
arrowleaf balsamroot	No Data	+	+	No Data	0	0
IDAHO FESCUE SERIES						
Idaho fescue	0	-	-/0	0/+	0/-	+/-
bluebunch wheatgrass	-	-/+	0	0/+	0/-	0/-
prairie junegrass	+	0	+	-	0	-
Sandberg's bluegrass	-	0/+	-	-	0/-	0
annual bromes	+	0	0	+/-	-/+	+
creamy buckwheat	-	-	No Data	0	+	No Data
western yarrow	0/-	-	+/0	0/-	0/+	0
arrowleaf balsamroot	No Data	-	No Data	No Data	0/-	No Data
lupine	-	0/-	No Data	0/+	0	No Data
red avens	-	-	No Data	0	No Data	No Data
twin arnica	-	+	-	0	No Data	0
tall annual willowweed	No Data	0	0	No Data	+	+
prickly lettuce	No Data	0	+	No Data	0	+